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PENETRATING CRANIAL WOUNDS
A SUMMARY OF METHODS USED IN MANAGEMENT
Collective Review

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INTRODUCTION

RECENT literature pertaining to the management of cranial wounds in World War II has added important new information to the older concepts of treatment. The reports which are continually reaching publication serve to advance our knowledge and unify opinion. Any general review of this subject must consider the present incompleteness of information. We propose merely to summarize the experiences of various observers to date in the interest of consolidating reports and to emphasize the application of the measures employed in war surgery to related civilian injuries.

This summary is devoted mainly to a consideration of penetrating wounds caused by bullet or shell fragment missiles (Fig. 1). Injuries of this class produced by forces peculiar to high velocity represent a unique neurosurgical problem. Penetrating types of civilian cranial injuries of low velocity present quite different requirements in care. The difference in the degreee of destruction of scalp, skull, and cerebral tissue dictates the differing principles in surgical management. The radical measures employed in the débridement of high velocity wounds are not required in the less destructive, low velocity civilian injuries (hammer, blackjack, rocks, knives, car door handles, electric fan blades, stationary objects). This distinction is made at the outset since only brief consideration is given to the usual low velocity type of penetrating wound as encountered in civilian practice.

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The survey includes observations made in 300 patients with cranial wounds produced by missiles of high velocity and treated in the 36th General Hospital which was located in Italy and in France. Because of the hospital's location, all types of wounds were observed, including one group of 40 cases of late wound débridement in German prisoners of war (210, 211, 212). The civilian patients with gunshot injuries of the brain were treated at the Detroit Receiving Hospital and Grace Hospital during a period of 20 years.

Before the principles followed in the care of patients with cranial wounds in World War II are described, a brief review is made of the history of the care of war wounds in general, and of those historical factors and opinions marking progress in the care of cranial injuries. The time periods are divided for consideration as follows: Early, World War I, Interim and World War II periods. The neurosurgical methods and technique employed in World War I are reviewed in some detail for comparative purposes. Brief consideration is given to the applicable physics of tissue destruction produced by high velocity injuries. A group of nonmilitary gunshot wounds of the brain was included in order to evaluate methods of treatment used in civilian practice.

HISTORICAL

EARLY PERIOD

It has been reported that the first use of gunpowder by the English was in the Battle of Crecy in 1346 (120). The poisonous nature of the wounds so produced was described by Giovanni da Vigo (1460–1525), surgeon to Pope Julius II,

who stated that all gunshot wounds "are not only contused and burned (requiring moist applications) but also poisoned by the powder (requiring dessication), and hence difficult to cure" (120). "He advised cauterizing the wounds by means of boiling elder oil or actual cautery." Brauns Weig, a surgeon of Strasbourg, and others agreed with this plan during the 15th century (80). A new era was thus begun in warfare attended with "superstitious terror" aroused by the use of the new weapons which produced remarkable noise and flame upon discharge and profound acute and late effects upon human tissue. In the attempt to relieve the body from the process of poisoning, "the openings of entrance and exit and track of the ball were incised; the wound dilated by tents or other means; terebinthinates or boiling oil poured into it; irritating compounds and ointments applied; and it was only after the wound was considered to be fully purged of its venom and foul humors by the extensive suppurative action thus kept up, that cicatrization was permitted to be established" (95).

The 16th century marked the beginning of a revolutionizing treatment of war wounds in general. Alphonse Saenza, surgeon to Paul III from 1534 to 1549, in the early part of his career held the same views as Weig and Vigo as to the poisonous nature of gunshot wounds. He made important improvements in wound management, advising upon the search for balls, their extraction, and upon the subject of dressings (80). Later in this era, Ambrose Paré (144), leading surgeon of the Renaissance and "founder of military surgery as a science and art," discontinued the early practices, merely dressing wounds after applying a "digestive." (33) Maggi of Italy supported the doctrines of Paré, which were published in a treatise on gunshot wounds (80). Leone, Botal, and Fallopius "at once embraced the views of these eminent masters; and Felix Wurz of Germany about 1576 wrote against the employment of too complicated instruments for the extraction of balls; deprecated trephining for depressed gunshot fractures of the skull; advised the discontinuance of the application of fatty substances to gunshot wounds and insisted upon the antiphlogistic treatment" (80). In this century, Botallus (17) described foreign bodies in the brain. Complicating cerebral abscess was recognized but was not drained "even though it was recognized that death would result by expectant treatment." Opinion was confused as to the wisdom of removing bone fragments from fractured skulls; it was "believed wise to bore if fissure in the skull was present." Dyes were used to detect the discontinuities of the skull, a practice employed in the hippocratic era (128). A "Treatise on Gunshot Wounds" by Thomas Gale appeared in 1563 and was the first English publication on military surgery. This was followed in 1612 by the "Chirurgeon's Mate" by John Woodall; in 1667, by the "Eight Chirurgical Treatises of Richard Wiseman", one of which was devoted to gunshot wounds; and in 1678, by the "Treatise on Gunshot Wounds" by John Brown (80). In the 17th century, agreement was reached about the value of opening the skull for the drainage of purulent collections and for subdural hematoma (128).

During the latter part of the 18th century (1792), Percy (149) in the Manuel du Chirugien d'Armèe wrote, "The first indication of cure is to change the nature of the wound (gunshot) as nearly as possible into an incised one." This treatment by incision, a return to older practices, was widely used, particularly by the French, the reason for its use being that "it was necessary to obviate tension and prevent strangulation of neighboring tissue by tumefaction caused by inflammation arising in the track of the projectile" (95). The term "débridement" was used to describe this method of wound management. English surgeons opposed the French practice, following the advice of John Hunter who recommended a simpler and more rational treatment in an outstanding treatise published in 1794 and entitled, "Blood, Inflammation and Gunshot Wounds." Incision of the wound was advocated only "when something can be done for the relief of the patient by the opening (securing a wounded artery) or the future good arising from it" (106).

Heister (90, 128), referring to cranial wounds in the 18th century, made the following observation: "Gunshot wounds which affect the cranium are for the most part attended with great danger. For even those which appear very slight externally frequently bring on terrible symptoms by the concussion of the internal parts which they occasion—the internal laminae of the cranium are shattered, or the veins and arteries burst, in which case the extravasated blood has no vent, nor can splinters of the cranium be extracted. Death therefore must be the issue unless prevented by the trepan."

The Napoleonic Wars which ended in 1815 marked new progress in the care of gunshot wounds of all types. Mr. Guthrie (84) quoted Sir Astley Cooper as stating that in the Peninsular War between 1808–1815 "the art of surgery received from the practical experience of that war an impulse and improvement unknown to it before."

Baron Larry (117), in his memoirs of the Napoleonic campaign in Russia, Germany, and France clearly stated the principles which he followed in the treatment of cranial wounds. He reported that in a wound of the head "accompanied by a fracture of the cranium, should the fragments of bone be displaced and driven internally so as to injure the brain and dura mater, the trephine is indispensable. When the foreign body which has caused the wound is enclosed between the pieces of bone or has penetrated into the interior of the cranium—the case is again one which demands the application of the trephine. Finally, when the surgeon is assured of the existence of effused fluid under the cranium, this instrument is also indicated." He believed that the operation should be performed as early as possible recognizing that "inflammation is generally established in the meninges after the first twenty-four hours succeeding the occurrence of the injury." Guthrie (84) held similar views, subscribing to operative treatment based upon observations made in the Peninsular War. After suggesting that a cranial wound be examined with a blunt, flat probe to determine the extent of damage, he raised the question, "What is to be done when depression and breaking down of the inner table have been ascertained? There can be no hesitation—that in all such cases the trephine should be applied although no symptoms should exist, with a view to anticipating them. The old doctrine, it may be said in regard to fractures generally, is revived in these cases but on a principle with which our predecessors were not sufficiently acquainted. A patient very often survives a mere depression of the skull; he may, and occasionally does, survive a greater depression of the inner than of the outer table; but it has not been shown that he ever does survive and remain in tolerable health, after a depression with fracture of the inner table, when portions of it have been driven into the dura mater. The result of my experience has rendered it imperative to remove at once all portions of bone or foreign substances which have materially injured the dura mater although no symptoms of compression should be observed." Hennen (92) emphasized the importance of trephine for compression without fracture: "Where there is no wound, the case becomes dubious and we are reduced to act upon probability founded upon gestures of the patient, his sensibility to pain upon pressing on a particular spot, or we may be guided by what the French surgeons place much dependence on, viz., the existence of paralysis, which is most commonly on the side of the body opposite to the compressed portion of the brain."

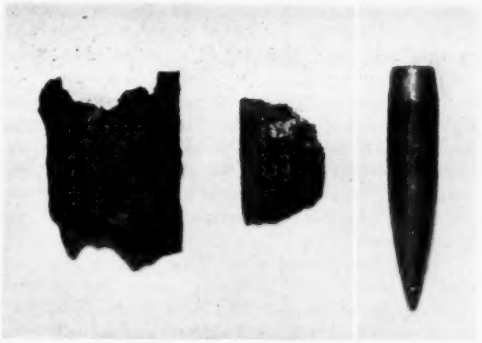


Fig. 1. Examples of penetrating missiles removed from the brain. Tiny bone chips and particles of clothing are present on the surfaces of the shell fragments.

The military operations in Algeria (1846), in Schleswig-Holstein (1849), and in the Crimean War (1854–56) presented opportunities to test again the applicability to military practice "of the great improvements accomplished in the civil practice of surgery in Europe since the termination of the war in 1815." The practice, generally, of "what has been styled conservative surgery," characterized the interlude between wars (95).

The trend toward conservatism in cranial surgery as well as in general surgery was demonstrated by the views expressed, and by statistics which began making their first appearance. Longmore (95) pointed out that a gunshot wound of the head had previously been an indication in itself for the use of the trephine; that earlier in the 19th century trephine was used for injuries without fracture. "Such preventive trephine has been proved to be useless as well as dangerous and is universally acknowledged not to be an admissible operation." He stated that the majority of the English surgeons after the Peninsular War limited the use of trephine to fractures with depression causing "interruption of cerebral function; fractures with bone indriven into the cerebral tissue; and where an abscess had developed and was capable of evacuation." The trend was to confine the practice of trephine "within still narrower limits." Stromeyer (95), an experienced German surgeon, reported 41 gunshot fractures of the skull with depression. Of the 41 cases, 7 terminated fatally. Of the 34 patients who lived, only 1 was trephined and "this was the only case of trephining which gave a favorable result in all three campaigns" (Schleswig-Holstein, 1849). Stromeyer had earlier advocated trephine but stated in his "Principles of Military Surgery"

that he had abandoned the practice (183). Macleod (122) in "Notes on Surgery of the War in the Crimea" reported that 67 patients with penetrating wounds of the skull had all died. In the treatment of 851 cranial wounds, the trephine was employed only 28 times and 24 of the patients died. Thus, the modest success of trepanation, based upon the results in two wars, resulted in endorsement of "the modern treatment of expectancy and the avoidance of operation except in rare cases" (122).

Macleod reported that "the teaching of all was to lead us to wait; to purge the patient thoroughly; to remove only such pieces of bone as could be got at with the forceps and which were quite detached and loose; to bleed, if need be, locally and even generally; to use cold applications when there was a fear of inflammation; to enjoin perfect rest, not only to the body generally, but, if possible, to the special senses also, by isolating the patient and thus removing the stimuli to their exercise; to enforce the lowest diet and to continue all this treatment for a long period, even after all danger seemed past; and finally to treat any incidental complications on general principles."

This extract is not only expressive of the opinions of a single individual but may be regarded as embracing the views of the majority of surgeons of this period (80).

Information resulting from the War of the Rebellion in the United States (126) raised some doubt as to the reasonableness of the conservative conclusions formed by the continental surgeons. Reports showed that successes attended surgical intervention in cranial wounds. Gross (80) published a comparison of the results of trephining compared with those of the expectant plan of treatment. Of 160 patients on whom the trephine was employed 60 per cent died and of 573 with serious conditions treated by expectancy, 74 per cent died. Of 126 cases in which fragments of bone were elevated or extracted, or foreign bodies were removed, 55 per cent were fatal. "After all operations of every kind the rate of recovery was 41 per cent. By the conservative or expectant plan only 25 per cent lived, making in favor of operative interference, 16 per cent of recoveries." Gross (80) reviewed the plan of treatment of cranial wounds proposed by Neudorfer (137) who was so prejudiced against the trephine that he not only did not use it himself but advised that it be excluded from the armamentarium of the army surgeon. He summarized the views of Stromeyer (183), Pirogoff (155), Legouest (119), Williamson (217), Demme (51), and Matthew (125) in showing the confusion of opinion. He pointed out "that the trephine is employed by surgeons of known experience and high reputation for widely different lesions and symptoms—that with one, its results have been invariably fatal and is positively contraindicated under all circumstances. With another, the results have been so favorable that its application is not restricted to a limited number of lesions" (Pirogoff, Legouest, Williamson). The variance in the experience between the American surgeons and those abroad was ascribed by Longmore (95) to the fact that "the former did not restrict the application of the trephine to otherwise hopeless cases and to the difference in the effect of the old round ball and the sharp, minie bullet."

Toward the end of the 19th century advanced opinion formulated the following policy in the management of cranial wounds: "When irregular edges, points or pieces of bone or foreign substances are forced down and evidently penetrate—not merely press upon—the cerebral substance or where abscess manifestly exists in any known site and relief cannot be afforded by simpler means at the wound itself, trephining is the proper operation; but in all other cases harm will probably be avoided by abstaining from trephining, while benefit will be effected by simply resorting to long-continued constitutional treatment" (95). It was recommended that if operation was necessary, "the earlier that it is done the better."

Three years following the War of the Rebellion (1867), Lister's principles of antisepsis were enunciated, although in the Franco-German (1870–71) and in the Russo-Turkish (1877–78) Wars, wounds of all types continued to be treated by unclean methods. Injuries up to this period were caused mainly by muzzle loading rifles and large caliber balls, although in the latter part of the Crimean War muskets were being transformed into "armes de precision" with rifled barrels and smaller balls. There were few wounds produced by artillery fire (127).

The magazine breech loader was introduced in 1892 and the use of this weapon greatly influenced the type of wound produced and the resultant requirements in wound care. Used during the Spanish American (1898) and the South African Wars (1890–91), this type of rifle fired a conoidal type of missile which resulted in a minimal degree of track damage (127). Wounds thus produced were effectively treated by means of a simple dressing and the results were satisfactory since, in general, primary wound healing occurred (134). Senn (176), Chief Surgeon, in the Spanish Ameri-

TABLE I.—19TH CENTURY MORTALITY STATISTICS IN CRANIOCEREBRAL WOUNDS[1] (95)

Authority	Injury	Cases	Deaths	Per cent
Surg. Report Cir. No. 6. War Dept. Surg. Gen. Office, 1865, pg. 9 (War of Rebellion, U.S.A.)	Gunshot fractures and injuries of cranial bones	704	505	71.7
T. P. Matthew, Staff Surg. B.A., Crimean War (1854–56)	Gunshot wounds of head, of which 230 were contusion, fracture, penetration, or perforation	898	170	73.9
M. Chenu, Crimean Report (1854–56)	Gunshot fractures of the cranium	731	541	74.0
M. Chenu, Austro-Franco-Italian War of 1859	Wounds of head from all causes—contused, complicated undetermined, contusions, and unspecified (sans indications) injuries	770	456	58.5
	Complicated wounds from musket balls	212	111	47.4
	Cannon balls or shell fragments	22		
Inspector-Gen. Mouat in New Zealand War (1863–65)	Scalp wounds	20	—	—
	Injury of cranial bones	5	—	—
	Fractures of cranium with wounds of brain	11	11	100
Macleod, statistics of Crimean War (1854–56)	Scalp wounds	630	8	1.1
	Fracture of cranium without known depression	61	23	37.7
	Fracture with depression	74	53	71.6
	Penetration of skull	67	67	100.0
	Perforation of skull	19	16	85.7
	Total	851	167	
Alcock (Spain)	Fracture	28	22	78.5
Ménière, War in India	Penetrating wounds of skull	9	7	84.4
Ménière, War in India	Penetrating wounds of skull	10	10	100.0

[1]Extracted from Holmes, System of Surgery, Philadelphia; Henry C. Lea's Sons, 1882.

can War, reported that "conservative surgery is the pride of the modern doctor on the field of battle. The stacks of amputated limbs that constituted such a gruesome and constant sight after every battle during the Civil War will never be seen again on the field of battle where modern surgery is practiced. The first aid dressing, properly applied at the right time, constitutes in the vast majority of cases, almost sure protection against infection of the wound. Prophylaxis has largely taken the place of operative surgery in the field. Our recent experience has demonstrated that the small-caliber rifle is the most humane weapon. If the wounded survive the immediate effects of the injury, the prospects of recovery are good. What a contrast with the experience of the surgeons during the Civil War only thirty-five years ago." At this point, artillery was still little used and high explosive bombs and land mines were unborn instruments of destruction. Records of the period indicated that shell fragment wounds were invariably infected.

Prior to World War I, von Bergmann (203), Papaillon (143), and Doyot (55) recommended operative treatment for penetrating cranial wounds, employing an "open" method. Zoege Von Manteuffel (205), in 1906, reported upon the inadequacy of the conservative management when used in the Russo-Japanese War (1904-5). In the "open" treatment, after débridement of the comminuted bone, neither the dura nor scalp was closed, which usually resulted in herniation of the brain and frequently the death of the patient. When this treatment was used in the Bulgarian Turkish War (1912–13) by Colmers (39), "70 per cent of all tangential gunshot wounds of the head with injury of the brain died of infection."

WORLD WAR I—GENERAL CONSIDERATIONS

Surgeons in World War I were unprepared to treat the type of wounds which they encountered because of two major changes in the instruments for wounding. The first was the increased velocity of missiles and the second was the frequent use of artillery fire in place of rifle injury to the extent that the ratio of gunshot wounds to those produced by artillery fire was reversed (18).

The concept at this period of a conservative management of war wounds of all types, even with the knowledge of asepsis, proved to be a failure. Established methods resulted in a high incidence of morbidity and mortality due to infection (66,189). Since antiseptics were in vogue, early use was made of various solutions to cleanse the

wounds, including those of the skull. These efforts to sterilize tracks without removing devitalized tissue failed. "Débridement" of the infected wound by simple drainage of the products of inflammation (an old established method [149]) was employed along with antiseptics to dissolve destroyed tissue and inhibit infection. Continuing failure, however, finally resulted in a technique of excision of devitalized tissue in the track of the missile, either bullet or shell fragment, followed by a delayed primary closure (127). This was found to meet the requirement for satisfactory wound healing in soft tissue wounds and it influenced concepts related to the treatment of cranial injuries. Early in the war many reports appeared in the literature advocating excision of the wound track and removal of bone fragments and foreign bodies [Roberts (161), Joll (110), Tabuteau (187), Barany (11), LaPointe (116), Weiss and Gross (213), Frey and Selye (64), Gross and Houdard (79), Anderson (2), and others.] Some authors suggested treatment of the wound from 2 to 5 days after injury [Sargent and Holmes (170), Whitaker (215), Holmes (96), Sargent (168)]. The old term "débridement" was used to describe the method of wound excision developed during World War I.

It was reported that early in World War I the results of operations for penetrating wounds of the head were "lamentable" (127). The estimated operative mortality varied from 50 to 65 per cent (Mathieu [123], Derache [54], Monprofit and Courty [132], Spick and Jaureginberry [180].) At the outset of the war there was no agreement by the participants concerning the management of this class of the wounded. Decisions upon when, where, and how to operate upon these cases had not been made. In the American Medical Department instruments for cranial operations were not available. The "open" method in treating cranial wounds was accepted by Whitaker (215), Moulonguet and Legrain (135), Hunt (105), and others at the start of World War I. The British military surgeons followed, in general, this technique of management upon the recommendation of Sir Victor Horsley (215). The following five procedures were advised:

1. The injured and septic area of the scalp must be freely excised.

2. The injured area of skull must be freely exposed by suitable incisions and the turning down of a suitable flap.

3. Normal dura mater must be freely exposed around the entire circumference of the wound which penetrates it, by means of a wide removal of bone.

4. Foreign bodies, blood, and pus must be removed from the brain without the breaking down of protective adhesions.

5. The wound must be left open from the first.

There were some surgeons who still deprecated any surgical interference. According to Joll (110) "This school claimed that the spread of sepsis is favored by operation, and the mortality is increased. It teaches that the brain, if left alone, is able to localize sepsis; that abscesses may become absorbed and that operation should be resorted to only in the presence of definite indication that sepsis is spreading." It was recommended by Sargent and Holmes (170) that "The dangers of earlier operation were greater than operation undertaken after from three to five days (from injury)." In the operative technique, use was made of a metallic cylinder ⅜ inches in diameter and 1¾ inches in length which was placed in the débrided brain track for 5 days postoperatively. The wound was then closed about the drain.

The practice of "intervention prècoce et systématique" (43) was employed by the French and the results in patients so managed were reported by Weiss and Gross (mortality 46%); Gayet (mortality 50%); and LaPointe (mortality 58%) (43). Tuffier (197) recommended a direct and immediate "excision of the soft parts, extirpation of fragments of bone and drainage without touching the foreign body at first." He stated that "immediate trephining" was employed also by Auvray, Chavannaz, Rouvillois, Pauchet, and Broca. The fluoroscope and roentgenograms were commonly used in the localization of the foreign bodies during exploration (Villandre [200], Rouvillois [163], Cazamian [34], Anderson [2]).

The German method as stated by Bainbridge (10) consisted of treating cranial wounds by "exposure, without delay, of all recent, untreated gunshot wounds of the head." The dura was incised and the cavity drained by means of a rubber tube around which gauze was packed. The tube was removed in from 2 to 8 weeks. Von Eiselsberg (204) expressed the opinion that tangential wounds of the skull should be operated upon as quickly as possible. He advised removal of the bullet if accessible or if associated with suppuration. The mortality with these methods of treatment was reported as being 34 per cent in all primarily operated gunshot wounds of the brain, and 67 per cent in secondary operations. Of 284 patients with open wounds of the brain, Steinthal (181) reported 89 had died (31%), 118 had returned to duty, and 77 were still under treatment. The causes of death in the fatal cases were abscess of the brain, encephalitis, and meningitis.

A policy of early operation, débridement, and complete closure of the cranial wound was recommended by Barany (11, 12, 13), Willems (216), and Cushing (44), being first suggested in 1913 by Clairmont (36) and Colmers (39). Barany (11) particularly grasped the importance of the removal of devitalized tissue and closure of the dura and scalp without drainage. Cushing (44,127) announced a surgical policy in dealing with this type of wound in 1918, advising a catheter suction method of débridement. Ultimately, this technique became a standardized procedure. In view of this fact, a detailed description is presented of the "Directions to Neurosurgical Teams" as outlined by Cushing (127).

It was first recommended that every scalp wound be considered as a potential penetrating wound of the skull and brain, a principle founded upon the observation of Hippocrates, "*Nullum capitas vulnus contemnendum.* As a part of the general attitude toward all wounds, an all or nothing plan of débridement was recommended. The observation was made that patients with penetrating wounds of the brain were able to tolerate transportation rather well before operation, but poorly during the first few days after operation. It was held that craniocerebral cases "in more or less shock need not undergo a period of resuscitation." Local anesthesia combined with morphine was suggested as the most suitable anesthesia (49). The directions stated "that the chief source of the high mortality in cranial wounds was infection—infection of the meninges, direct infection of the brain leading to encephalitis, and infection of the ventricles."

The principle recommended in the operative technique was the removal of the contaminated wound margins, and of all foreign material from the brain along with devitalized brain tissue. The "tripod" incision was advised to provide exposure of the underlying bone defect. The directions stated "only in the case of large scalp defects is the switching of flaps necessary for closure, and it is questionable whether this is desirable." The technique suggested for the exposure of the brain track was the use of three or four perforations about the skull defect and the tilting up and removal of the bone "en bloc." It was advised to leave as small a bone defect as possible—a quarter of an inch margin beyond the defect suffices. The area of dural laceration should not be enlarged. The débridement of the contused brain and track can best be carried out with production of the least damage to the brain by gentle suction and irrigation with a soft rubber catheter. The catheter detects indriven bone fragments as well as does the finger and then these can be picked out with delicate forceps. Metallic fragments of small size are surprisingly well tolerated. No mention is made in the technique outlined concerning the closure of the dura. Horrax (102) and Rand (158) have stated that it was usually not closed since, as the latter reported, "the incidence of sepsis where the dura was closed was disproportionately high." Use was also made of dichloramine T in oil as an antiseptic "particularly suitable for infections in the central nervous system tissues."

Craniocerebral wounds were classified into 9 special groups based principally upon the type of damage produced. These groups and their percentage of mortality were as follows (127), (45):

1. Wounds of the scalp (about 5%)
2. Cranial fractures without dural penetration (10%)
3. Cranial fractures with depression and dural penetration but without extrusion of brain (20%)
4. Wounds usually of gutter type with brain extruding and indriven bone fragments (30%)
5. Wounds usually of penetrating type with indriven bone fragments plus metal (40%)
6. Wounds types 3 and 4 with penetration of bone and metal opening the ventricles (50%)
7. Craniofacial wounds or orbitofrontal or temporopetrosal wounds in which the ethmoid or petrosal sinuses are open (60%)
8. Perforating or traversing wounds (70%)
9. Extensive bursting fractures with fatality usually due to trauma rather than infection (100%)

Harvey (88) recommended that every case in Group 2 should be explored and trephined; that if the pathway from the external wound to the fracture is continuous then infection will, in many cases,—even with the simple depressed fracture without dural penetration—lead to meningitis or an abscess in a contused adjacent cortex." The statement was made in Harvey's report that patients in whom the dura was closed did "badly." As a general policy it was advised to allow the dura to remain open, and in addition to drain the scalp with a small rubber wick to prevent damming back of the infection which would lead to meningitis or a cortical abscess. It was noted that in the gutter type of wound, classified as Type 4, the probability of infection was of the greatest degree, and it was held "that wounds in which infection of the scalp or its intracranial contents is problematical should be left open for free drainage." Penetration of the ventricle was found to result in a high mortality. (Cushing noted no recoveries in patients in which the ventricle was penetrated by a metallic pro-

jectile.) The management of wounds involving the orbit consisted of enucleation of the destroyed eye, and removal of the indriven bone fragments from the bony orbit and the pulped brain from the track. Bilateral decompressions were sometimes performed on extensive bursting fractures, but recovery was unusual.

The mortality rate including the results in all types of wounds with dural penetration was 37.5 per cent, being reduced from 54.5 per cent in the first group of patients to 28.8 per cent in the last group (44).

BRAIN ABSCESS, FUNGUS, AND MENINGITIS—WORLD WAR I

The report by the Surgeon General (127) summarizing the complications observed following penetrating wounds of the brain stated that the "principal cause of death in patients with head wounds after return from overseas, was abscess of the brain." The abscesses frequently occurred in cases in which there were retained foreign bodies. In 219 cases Cushing encountered 8 instances of brain abscess within a few weeks of injury (24). In 37 cases studied by Sargent and Holmes (169, 170), the overwhelming frequency of brain abscesses in the first three to six months after injury was shown; 28 patients developed abscesses in that period, whereas the complication appeared in a 6 to 9 month interval in an additional 7 cases. The latest appearance of brain abscess was in the eighteenth month. The history of World War I recorded that multiple abscesses were found to be practically always fatal, and recovery from "a brain abscess without a capsule was extremely rare" (127). It was stated that the primary stage of abscess formation was one of septic encephalitis for which surgical procedures would give no relief. The ideal time for operation was after the formation of the capsule. "It is sometimes difficult to determine just how drainage of pus should be accomplished or whether simple aspiration with a needle should be made" (127). The procedures used for the drainage of abscesses varied in magnitude from the use of an osteoplastic flap to that of a simple trephine opening. It was noted that the best results in the treatment of this complication were obtained in the drainage of single abscesses with capsules. A second opinion stated that "consideration of all the facts justifies the conclusion that the most favorable time for accurately placing a drainage tube in an abscessed cavity is when the pus is first discovered. It is often possible to empty the abscess completely at this time, and there may be very little subsequent discharge. The drainage tube should be fixed to the scalp and should not be removed until drainage has discontinued" (127). Brain abscess unrelieved by operation was considered to be fatal; yet the vast majority of patients (97.5% in Sargent and Holmes' series) died after the drainage of pus (138).

Fungus was observed to be one of the most frequent complications following the drainage of cerebral abscess, and the mortality was high. A fungus was the "result of an undrained abscess with or without hydrocephalus or an encephalitis." The notation was made "that the treatment of the condition of fungus is as a rule unsatisfactory." It was held important that any associated accumulation of pus should be drained (127).

RETAINED FOREIGN BODIES—WORLD WAR I

Prior to World War I, a conservative attitude was taken toward the removal of foreign bodies within the cranial cavity, as pointed out by Pilcher (152) in an excellent review of this subject. Sir Benjamin Brody, in 1828 (20), approved of this policy. Later, however, cases were reported in which the foreign bodies within the brain substance were removed. In the Medical and Surgical History of the War of the Rebellion (126), 85 cases of bullet removal were reported. Andrews (4), in 1868, and Wharton (214), 10 years later, advocated the removal of retained bullets when they were localizable and accessible. Morris (133), in 1887, Papaillon (143), in 1894, and Hewett and Lidell (93), in 1881, held this same view. Phelps (150) in 1906 stated, "There is probably no authenticated case...in which the bullet left in the brain substance has failed to work mischief." DaCosta (46), in 1910, wrote "that practically every lodged bullet (in the brain) constitutes a fatal condition and it should be removed if possible, even if there are no symptoms."

Following the use of roentgen rays in visualizing and localizing intracranial foreign bodies, first suggested in 1896 by Stubenbord (152, 184), removal became a more practical procedure, and was more widely practiced. (Rouvillois [163], Cazamian [34], Regard [159], and Villandre [200] recommended removal of all foreign bodies.) As a result it was observed that a relatively small number of retained foreign bodies were discovered in patients with head injuries following their return to the United States after World War I (127). In two series aggregating 392 patients with head injuries at general hospitals, 29 had intracranial foreign bodies which were either pieces of metal or bone fragments. Frazier and Ingham (63) reported "our percentage of retained foreign

bodies which is 10% is almost identical with that recorded by Sargent and Holmes, 164 in 1,567 cases, or 11%." Of a series of 9 patients with retained missiles treated by Bagley (9), 7 were operated upon. Four had an associated abscess with a positive culture. In 3 cases there appeared to be no signs of brain disturbances from the foreign bodies and in these the cultures were negative.

Frazier's (127) indications for the extraction of foreign bodies were as follows: "Foreign bodies causing encephalitis or epileptic seizures should be extracted; those apparently latent should be left alone." This opinion was subscribed to by Bagley (9), Demmer (52), Von Eiselsberg (204), and Coleman (38). Wagstaffe (206) noted that the incidence of epilepsy was slightly higher among those with retained foreign bodies.

INTERIM PERIOD BETWEEN WORLD WARS I AND II

Interest in penetrating cranial wounds slackened after reviews were made of war experiences by World War I authors. The final surgical techniques evolved were considered as satisfactory. The possibilities in neurological surgery revealed by the war focused attention upon civilian neurological problems. A rapidly broadening field resulted in the training of a number of general surgeons into neurological surgeons who became experts in this particular speciality and in due course of time trained others.

There was thus available at the start of World War II a considerable number of trained neurosurgeons as well as a rapid means of training additional men through short courses or by preceptorship. In contrast to World War I, this was a major advantage, true in all specialties when medicine mobilized for war.

A second advantage at the start of World War II lay in the improvement in transportation and its means of mass production. Slow and inadequate methods formerly used were replaced by streamlined methods employing a greater number of men, units, and vehicles, and the air as a medium for transportation. Expeditious evacuation from the point of injury to hospitals for definitive treatment, recommended early by Tonnis (191), was constantly a foremost consideration, although it was subject, at times, to insurmountable difficulties. This factor was of major importance in the management of cranial wounds (114).

Research during the interval between the wars had resulted in the introduction of sulfonamide drug therapy in 1936 with evidence of astonishing results in the treatment of infection.

Sulfonamide therapy was observed to be particularly efficacious in the treatment of infections caused by the streptococcus of the beta hemolytic type, the Lancefield Group A hemolytic organisms, the meningococcus, pneumococcus, and gonococcus. Staphylococcal infections, however, were not benefited to the same degree. The mode of action of this drug by bacteriostasis permitted the control of infection of the central nervous system following cranial wounds in a high percentage of cases.

A widening knowledge concerning body chemistry, fluid balance, anoxia, blood replacement, the treatment of shock, and wound healing added significantly to the effectiveness of the surgical treatment.

The pathophysiological conditions of the brain resulting from trauma were more clearly understood. Many contributions to the literature, both of an experimental and clinical nature, had been made during the interval between World Wars I and II.

An important contribution pertaining to the improvement of the technique for the débridement of penetrating wounds was made by Horrax (99) in 1940. He suggested that such wounds be treated by more radical excision with coning of the track of devitalized tissue in place of the catheter suction débridement. This suggestion, later put into practice in World War II, proved to be a significant aid in treatment.

Under these circumstances, neurosurgeons, in general, faced the cranial wounds produced in World War II, adequately prepared, organized, and equipped.

MECHANISM OF INJURY FROM BULLET AND OTHER PENETRATING WOUNDS

Wounds from high velocity bullets and shell fragments are relatively recent experiences in military surgery. It is only during the past 60 years that high velocity bullets have come into use, and only since World War I that high velocity shell fragment wounds have been noted with frequency. Whereas a low velocity weapon may traverse the body, mainly with injury to the immediate neighborhood of the track, high velocity missiles cause extensive damage also at a distance from the track in the tissues. It is not uncommon to see organs, bones, and other tissues severely damaged at some distance from the bullet passage. Usually blood vessels and nerves are more resistant because of their elasticity and thus they may escape anatomic injury. On the other hand, vessel injury may be seen at a distance from the missile track by "splash" of the blood against the

intima with longitudinal tears. Thrombosis, secondary tear with hemorrhage from necrosis, or aneurysms, may ensue.

The agents of injury especially concerned in this study include bullet and shell fragments, as well as certain tools and utensils used in low velocity penetration of the cranial cavity. In most instances, pointed bullets are seen in military injuries, whereas round nosed missiles are found in civil practice. In practically every instance, bullets used in military practice are jacketed with a core of lead in the center. Jacketed bullets usually retain their shape except at impact with bone at velocities of 2,500 feet per second or more. In civilian practice with soft bullets, it is common to see the missile shattered into many fragments at impact. In rifle injury the muzzle velocity of the bullet may be 2,000 feet per second or more, and the rifling causes the bullet to rotate about its long axis approximately 3,000 times per second with a velocity of 500 or more feet per second. Sir Victor Horsley (104) has attributed the explosive effect of high velocity missiles to the rotation of the bullet about its axis rather than to its muzzle velocity. This will be discussed in greater detail in the next few paragraphs in connection with recent experiments pertinent to the problem.

Shell fragments may have extremely high velocities, and it has been estimated that they may travel from 4,000 to 5,000 feet per second near the site of explosion. They vary in size and shape and they are more likely to become contaminated with clothing, hair, and helmet lining, which may be introduced into the cranial cavity. Whereas bullets usually cause a neat wound of entrance and possibly also a clean wound of exit, shell fragments may cause large, lacerated wounds of entry. In accordance with the velocity, irregular tears or bruises of the struck area may be seen. Frequently the fragments remain in the cranial cavity. It is interesting to note that in certain instances tiny fragments may be dispersed within the cranial cavity. Among this group of cases there may be instances of relatively little brain damage.

Low velocity penetrating wounds of the skull and brain may be produced by knife blade, ice pick, glass, umbrella end, and many other tools or every day objects. Ordinarily, infection is seldom introduced into the cranial cavity and this may be partly explained by the fact that during the period of thrust, dirt particles are held back as the object enters the scalp and skull.

A very important difference between high velocity and low velocity injuries is to be found in the type of damaged brain about the missile track. With high velocity injury, there is pulping at long distances, whereas with low velocity bullet wounds and with stab and similar penetrating wounds, there may be no damage except for the track in the tissue. Wilson (218, 219) states that "the wounding effect depends upon, first, the amount of energy transmitted to the tissues; second, the velocity of transmission; third, the direction of energy; and fourth, the density of the tissue." The amount of energy transmitted to the tissues depends mainly upon the velocity of the weapon. Mass times the square of velocity divided by 2 is the formula to calculate the amount of energy. With velocities up to 2,000 feet per second the amount of energy utilized, as evidenced by damage done by the missile, is proportional to the square of the velocity. The time of transmission of energy to the tissues is extremely important and this depends upon the velocity of the injuring object. The shorter the time of transmission, the greater the horse power expended in a unit of time. Callander (30) states that with extremely high velocities the wounding effect of the missile varies as the cube of the velocity, and only as a single power of the mass. The density of the tissues is also important. Wilson (218, 219), working with gelatin solutions, concludes that the energy of the missile is dispersed inversely to the square of the percentage density; that is, in a 5 per cent gelatin solution explosive effects are approximately 4 times as great as in a 10 per cent solution, 9 times as great as in a 15 per cent solution, and 16 times as great as in a 20 per cent solution. The velocity imparted to the tissues about the track is important in that bits of tissue, bone fragments, and other organic matter may act as secondary missiles with more extensive injury. If a bone is struck by a high velocity missile near the wound of exit, there may be extensive shattering with skin loss. Ordinarily the elasticity of the skin protects it from extensive tears and lacerations. Whereas a discreet wound of entrance and exit may be seen with a high velocity bullet injury of the thigh, the skinned extremity of the same experimental animal will be shattered to bits by the same missile injury (31).

The pulping effect at a distance from the missile track has been the basis for much experimental work. Sir Victor Horsley (104) attributed this to the "explosive effect" of the bullet in its passage through the tissue. He thought that the rotational activity of the bullet, rather than the muzzle velocity, caused the "explosive effect." Recently Black, Burns, and Zuckerman (15, 220)

have shown that when a high velocity pellet without rotational acceleration enters a gelatin cube it causes a tail splash at the entrance. As the missile traverses the gelatin there is a marked swelling and enlargement of the cube to 4 or more times its previous size. This is caused by the formation of a temporary cavity, which almost completely disappears as the pellet passes through and the gelatin cube returns to its former size. Black, Burns, and Zuckerman (15, 220) emphasized that rotation of the bullet on its long axis in rifle injuries is not the cause of the "explosive effect." However, they admit that a change in the position of the bullet as it enters the tissues or as it passes through the same because of precession, may alter the dimensions of the track, but the temporary cavitation about the track is due to radial velocity imparted to the walls of the track by the passage of the missile. Butler, Puckett, Harvey, and McMillan (23) have studied the passage of spherical missiles with the use of a microsecond x-ray apparatus with which x-ray pictures may be taken in one-millionth of a second or less. They have shown that in its passage through the cranial cavity the missile causes a large temporary cavity, which expands rapidly and undergoes several pulsations before the tissues return to preinjury dimensions. The passage of the missile causes high radial velocity imparted to the tissues about the track which in turn causes the temporary cavity. Within the cranial cavity this produces an intense increase in intracranial pressure with maceration and pulping of tissue at long distances from the missile track and extensive disorganization of the cranial bones with fragmentation and separation at suture lines. In order to show the role of the intracranial contents in such injuries the following experiments were carried out. A cat, under anesthesia, was struck in the head with a sphere 4/32 of an inch in diameter, with an impact velocity of 3,800 feet per second. There was extensive fracturing of the skull with fragmentation and separation at suture lines. In another cat, the skull was cleansed of the soft tissues and brain, and a similar injury merely caused a wound of entrance from 6 to 8 times larger than the sphere and a small wound of exit only a little larger than the missile. The comparison of the perforations of the skull in this instance with the extreme fracturing and fragmentation in the experiment in which the intracranial contents were intact is most convincing.

Wounding by shell fragments has been extremely common in World War II. Only 15 per cent or less of the cranial wounds entering the evacuation hospital were from bullets. The greatest majority of the bullet wounds of the head caused death on the field of battle. Shell fragments vary considerably in size, shape, and contour. They may travel at extremely high, and then again at low, velocities. The irregular contour causes extensive laceration and the missile is more prone to carry dirt and foreign matter into the body. The mode of injury is essentially the same as with a high velocity bullet if the fragment is stopped by the body while travelling at a high speed. Severe lacerations of the brain with pulping of the cerebral substance along the track occurs. In many instances, penetrating shell fragments remain in the cranial cavity; a few may perforate.

In penetrating, low velocity wounds, such as those caused by knife blade, umbrella end, or fan blade, there may be a tearing of important vascular channels and infection may be introduced into the cranial cavity. The brain about the track of the missile is not pulped and therefore can successfully resist certain amounts and types of infection.

The mechanism of sudden death following penetrating wounds of the brain has been investigated by Polis (156), and Webster and Gurdjian (209). It was observed to be due to a paralysis of the vasomotor and respiratory centers in the medulla. With an increase in the velocity of an injuring bullet, there was a corresponding increase in the severity of the physiological effects.

Methods of Treatment—World War II

Certain generalizations regarding the treatment employed in World War II warrant mention as a preface to the details of operative technique used in high velocity wound management. Among these is the attitude toward patients with cranial wounds. The treatment of this group of patients was undertaken not only from the standpoint of rehabilitation for further duty but as a humanitarian obligation. Regardless of the severity of the wound, the courage required in the collection of the patient from the point of injury, the time employed in primary care, or the efforts consumed in effecting postoperative recovery, a conscientious effort was made to accept that responsibility by all personnel involved. This philosophy on the part of surgeons, nurses, company aid men, and hospital corpsmen was a significant factor in the excellence of the care which these patients, in general, received.

The campaign in Africa and in Italy early established the value of the neurosurgeon in the Evacuation Hospital and set a pattern which settled any doubt as to where the treatment of

cranial injuries should be carried out, in either a fast moving or a stationary type of warfare. Auxiliary surgical teams supplied the personnel for these hospitals if neurosurgeons were not available. Following operation and after a period of observation in the Evacuation Hospital for from 5 to 10 days, the neurosurgical patient was evacuated to a "Neurosurgical Center," a general hospital so designated, for late postoperative care and convalescence. General hospitals were deployed as near to major activity as possible, reaching such positions for operation within one month after an invasion.

A second practice of major importance was the modification of neurosurgical operative technique to war wound needs following the suggestion made by Horrax (99) in 1940. The availability of electrocoagulation and efficient suction units resulted in the adoption of more radical measures in débridement. It was also recognized that "brain areas could be wholly or partially removed without detriment to the individual" (99). By the older technique "a careful, but necessarily slow and tedious débridement of the wound in the brain was accomplished, an average of two hours being required for the serious, deeply penetrating wounds" (99). By modernizing the technique, operations were performed rapidly with time saving short cuts. Skillful, co-operative, smooth functioning teamwork usually assisted the surgeon. Ability, experience, and confidence acquired in previous training implemented the surgeon's desire to accomplish his purpose as quickly as possible. Laborious attempts at hemostasis were replaced by rapid coagulation; slow irrigation débridement was replaced with total suction débridement of all devitalized tissue. Modern electrical apparatus provided necessary illumination. From the preparation to the closure of the scalp all but essential manipulations were eliminated.

PRIMARY DÉBRIDEMENT

All cases with scalp wounds were considered as cases of penetrating wounds of the brain unless proved otherwise and all but the obviously fatal wounds were explored (Fig. 2). Following neurological examination, routine roentgen studies of the skull were made. Stereoscopic views were held to be essential by some (32), but the pressure of work or failure of the patient's co-operation often made any additional studies impossible. Visualization of the bone fragments and actual count was attempted. In general, the neurosurgeon was able before operation to visualize the path of the penetrating missile and the degree of bone injury and imbedding of the bone fragments. Individual surgeons varied in their standards for determining the inoperable patient, but in general, except when the pressure of work was too great, all but the obviously fatal wounds were explored. Particular attention was given to the selection and operation of patients with increased intracerebral bleeding who failed to respond to resuscitation and those with intraventricular wounds (89). Intensive resuscitation measures were employed, consisting mainly of the transfusion of whole blood and plasma, the employment of warmth, rest, and pain relief, and the provision for adequate pulmonary ventilation. Craig (41) has recommended the use of oxygen to "help reduce increased intracranial pressure." The high incidence of associated injury (approximately two-thirds of the patients observed by Gaynor and Gurwitz (67) presented wounds in addition to that of the head) required consideration in planning treatment.

Eden (58) has stated "that there is no doubt that the surgeon who first operates on an open wound makes or mars it—ideally, the initial operation should be the final and complete one." The principle of an "all or nothing" débridement stressed by Cushing (127) was followed in principle although not always attained. The scalp was prepared by complete and thorough shaving and washing about the wound with soap and water for 10 minutes. The use of an antiseptic was elective. Local infiltrative anesthesia was used whenever possible, supplemented by the use of preoperative morphine analgesia. Cairns (24) has objected to the use of morphine, while Horrax (101) believes it may be used in widely open compounded wounds. Slemon (178) used local anesthesia in 56 per cent of penetrating brain wounds with a basal narcosis induced by alopon (gr. ⅓), scopolamine (gr. 1/150), and luminal (gr. 3). When a general anesthetic was required, the intratracheal administration of ether was preferred. Sodium pentothal has been used with success (129), but caution is required to control the depth of anesthesia (67). Supplementary pentothal anesthesia was used in 25 per cent of the patients operated upon by Munslow (136).

Long curved incisions of the scalp which included the total excision of the wound of entrance were made in place of the "tripod" type formerly used. They were planned to permit an adequate blood supply to the scalp. The incision was designed with the purpose of securing scalp closure at the end of the operation. The pericranium was carefully removed from the bone defect after débridement since its later use for dural grafting

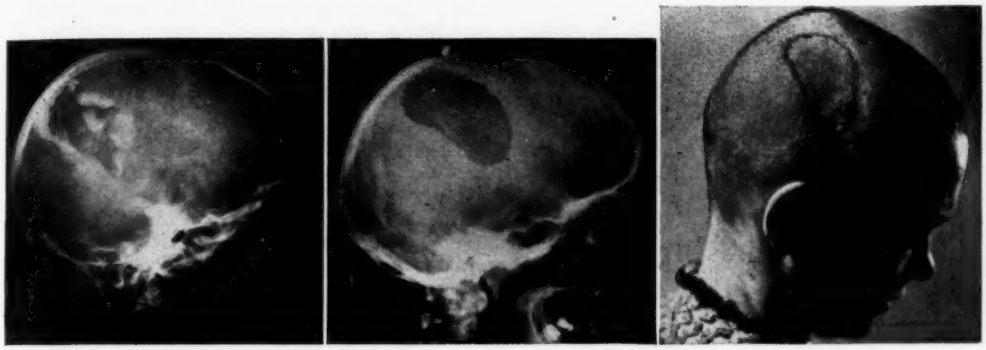


Fig. 2. Civilian patient presenting a gutter type wound of the right parietal area by a 38-calibre revolver, self inflicted. She was operated upon 6 hours after injury. Through curved incisions the area of bone defect was exposed, fragments of bone and pulped brain tissue were removed. The dura was débrided. The dural defect was repaired with a fascia lata graft. The bone defect was subsequently repaired with tantalum.

was possible. The bone defect was enlarged with a rongeur. Frequently a bur opening was necessary adjacent to the point of entrance. Fragmented bone was removed as well as any additional bone to expose adequately the injured dura and brain. More severe fragmentation of the inner table has often been observed (57). The "en bloc" method of bone removal was usually not employed. After the excision of damaged dura, the track of the missile in the brain was "débrided" by suction removal of the devitalized cerebral tissue, blood clot, and bone fragments. A coring of the track to normal tissue was frequently accomplished under direct vision with a lighted retractor as suggested by Horrax (99). The utmost care was employed to spare injury to the cortical vessels. Foreign bodies were extracted if at all possible, the electromagnet being employed by some. Entering the ventricle was avoided but not at the sacrifice of incomplete débridement. Saline solution was used in irrigation of the track and wound, although not advised by Munro (8). When doubt existed as to whether all bone fragments were removed, the finger was gently used in the large tracks to feel for the fragments. The dura was closed by means of a graft of pericranium, temporal fascia, fascia lata, or preserved cadaver dura. Cushing silver clips were sometimes used in place of sutures by Haynes (89). In some instances, to conserve time, the dura was not closed. Two layer interrupted silk closures were attempted in all cases. Relaxing incisions were not used. In cases of severe scalp loss over a defect of skull and dura, a flap of scalp was used to cover the defect. The bare pericranium was immediately grafted (split thickness). An osteoplastic flap has been recommended in the small clean wounds associated with persisting neurological signs for exposing an intracerebral hemorrhage (25). The local instillation of sulfanilamide, penicillin, or combinations in the brain track and in the overlying wound was done by some surgeons (26, 58, 171). Cairns (26) stated that "in recent brain wounds (up to 72 hours old) penicillin can be applied in a powder (5,000 units of penicillin per gram of sulfanilamide) followed by primary closure of the wound." In 129 cases so treated, "fatal infection developed in only 2 cases." He stated also that "sulfanilamide and sulfathiazole have been used in some hundreds of brain wounds with no reactions of the kind described by Watt and Alexander (208). Following operation, all patients were treated systemically with sulfadiazine or penicillin, the chemotherapy begun at the time of wounding or shortly thereafter being continued. It was discontinued when the wound was healed.

DELAYED PRIMARY DÉBRIDEMENT (24 HOURS—10 DAYS)

The observation first made in World War I that patients with cranial injuries are transportable with greater safety before, rather than after, operation, resulted in a late primary débridement of cranial wounds being done in many instances (27). Unlike patients with delayed wound care in World War I who travelled well but ultimately died of infection, many of these patients survived. Generalized infection was usually prevented by chemotherapy, and the localized encephalitis was reduced in degree and even controlled. Thus patients in this class, in

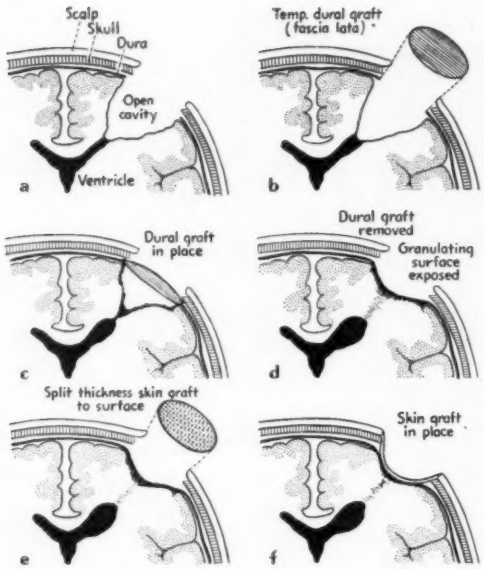


Fig. 3. Open exteriorization method of treating brain abscess with a graft of fascia lata in patients with massive loss of scalp, skull, and dura. The abscess is totally débrided; a temporary fascia lata graft is sutured to the intact dural edge, which prevents leakage of the cerebrospinal fluid and herniation; the scalp is not closed; penicillin solution is injected through the graft into the cavity. The temporary graft is removed in from 15 to 20 days and a split thickness graft applied to the area, the scalp being conserved for cranioplasty.

general, did not present wounds with an extruding brain and meningitis as formerly.

The surgical management of this type of wound was similar to that described under primary débridement. Success depended upon total wound excision and thorough débridement of the brain track. A dural graft was not used. The local instillation of penicillin for several days postoperatively, in conjunction with its systemic use, aided in wound healing. Terian (Russian) (188) reported experiences with delayed operations. In 71 per cent of 192 cases, operation was undertaken within 20 days after injury, usually on the sixth to eighth day. Eight of the patients died; 6 of these had meningitis at the time of operation. The fatality rate of 182 cases without meningitis was 1.1 per cent. The conclusion was made that "the time interval after wounding is less important in craniocerebral injuries than meticulous and specialized care in investigation, operation and after treatment." The dura was not closed in any of these cases and "the scalp edges only were apposed over the wounded brain by a few sutures."

Delayed primary débridement of craniocerebral wounds differs from earlier recommendations made at the start of World War II. Horrax (101) stated that after from 24 to 48 hours "the whole wound should be packed widely open under vaselined gauze or rubberized tissue and the resulting fungus allowed to heal by granulation and recede." Schulze and Betzendahl (173) also suggested that after 48 hours the penetrating wounds should be treated as a brain abscess with "open drainage."

SECONDARY DÉBRIDEMENT (10–30 DAYS)

Healed wounds presenting retained bone fragments within the brain were frequently encountered [Italy, 13.4%; France, 31.9% (210)]. These were usually the result of necessary haste due to lack of time at the primary débridement when the "all or nothing" rule was not followed. By means of roentgen studies the fragments were accurately localized and after evening of the bone defect a conservative secondary track exploration with removal of the bone chips was performed. This policy has been followed by Eden (58), Schwartz (174), Schorstein (171), and Rowe and Turner (165). When necessary, a dural graft was applied with safety since the wound was not grossly contaminated, as in patients requiring late primary débridement. The scalp was closed. Tonnis (191) reported that all cases which had been provisionally operated on for tangential wounds of the brain showed prolapse, with splinters of bone in the depths of the brain. The prolapse was reduced by repeated lumbar punctures. Under local anesthesia, the opening in the skull was then enlarged, the depths of the wound freed from dead matter, and any remaining splinters of bone exposed and withdrawn. The wound was kept open by a Mikulicz tampon, soaked in prontosil, to assure the free escape of discharge. It was noticed in the wounds which had not been tampered with at the front that prolapse of the brain had been hindered by the splinters of skull left in place. At both the primary and the secondary débridements, the attempt was made to remove completely all organic material, consisting mainly of bone chips and of the inorganic material when possible.

In general, the management of retained metallic fragments followed the principles set forth by Frazier (127). Some (67,210) have reported that ragged metallic fragments were found to be laden with organic material—tiny bone fragments, hair, and helmet lining—and cultures of such

missiles, as well as of bone fragments, usually resulted in the growth of pathogenic organisms. Not only the size of the metallic foreign body but the irregularity was of importance. It is reasonable to view the presence of retained shell fragments, particularly, as a threat to a future inflammatory complication. Such findings usually do not occur when the penetrating missile is a smooth intact bullet.

CONSIDERATION OF BRAIN ABSCESS

The term, brain abscess, as used in this article describes a purulent collection or collections within the brain substance which followed track injury produced by a penetrating missile. An incidence of 16 per cent occurred among 206 patients (including German prisoners of war) with penetrating wounds of the dura and brain observed by Webster, Schneider, and Lofstrom (210). The incidence among American wounded was 14 per cent in Italy, and 19 per cent in France (210). Cairns (27) has reported an incidence of abscess formation in 25 per cent of patients in whom wound débridement was incomplete or performed late. A similar proportion was estimated by Rowe and Turner (165). In Ascroft's series (25) 75 of 292 patients developed brain abscesses under his care. Eden (25), however, had but 1 case, attributed to the fact that "cases were received at an earlier stage and before they had been operated on by the general surgeon."

No case of abscess was noted among patients in whom the dura was not penetrated (210). The abscesses occurred early and were associated with wound infections and frequently with hernias or fungi. Usually they were not encapsulated but were localized by reactive inflammatory tissue of a dense quality at the site of the original débridement and also in the track produced by the missile or the bone fragments. Korneansky (114) noted that in 69 per cent of cases, brain abscesses "were due to an infection of the wound." In 28 per cent they were cortical and in 53 per cent intracerebral. They occurred 2 or 3 weeks after injury.

Several surgical methods of management have been employed in treating this type of complication (210). The techniques were based primarily upon a complete redébridement of the wound and the abscess by means of excision of all inflammatory tissue and the abscess itself, the latter being removed by suction. The resulting wound was then treated by (1) closure of the scalp, (2) closure of the scalp about a tube for the instillation of penicillin, (3) exteriorization of the cavity (21), and (4) exteriorization with a temporary dural graft (Fig. 3).

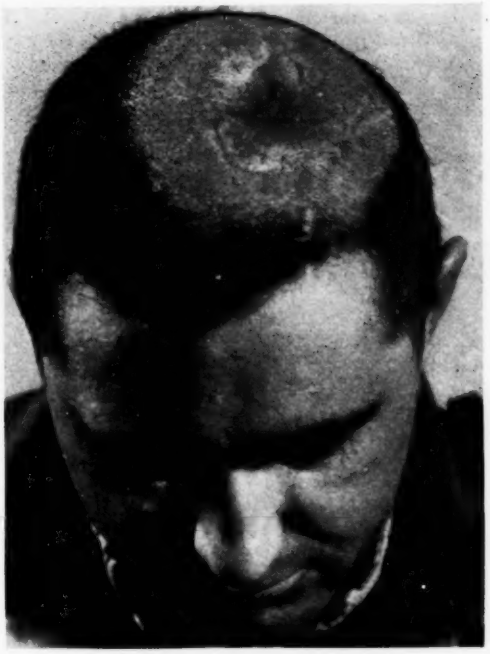


Fig. 4. This patient presented a brain abscess associated with a retained bone fragment and an infected wound. Management consisted of excision of the wound and the abscess followed by the daily instillation of penicillin solution through the scalp. Primary healing occurred.

Webster, Schneider, and Lofstrom (210) concluded that an early abscess following a penetrating wound of the brain must be treated by complete removal and not by drainage without excision (Schulze and Betzendahl [173] in 1940 recommended simple "open drainage"), and further that no single technique was applicable to all situations. There were situations in which it was possible to close tightly the overlying scalp after wound excision and extirpation of the abscess (174). This is a technique similar to that used for late purulent and nonpurulent undébrided wounds which has been successfully practiced with or without the local use of penicillin. Drainage of the abscess followed by the local instillation of penicillin through a small rubber tube placed into the cavity has been employed by Eden and Cairns (25), and Rowe and Turner (165). The latter use a technique of "complete evacuation of the abscess and the removal of all foreign bodies, establishing drainage by use of a Penrose sheath or rubber tissue drain or occasionally a soft rubber

tube. In addition, a Dakin tube is introduced into the depths of the cavity. At this time a mixture of dry penicillin and sulfanilamide is placed in the cavity. In contradistinction to the ordinary practice of leaving the wound entirely unsutured, it has been found feasible, with the aid of chemotherapy, to carry out a nearly complete closure in many cases." Webster, Schneider, and Lofstrom (210) found it difficult either to aspirate through a small rubber tube or to inject penicillin solution and were obliged to remove the tubes in 48 hours and inject the solution through the scalp (Fig. 4.).

In a number of instances these methods were not successful; namely, when the frontal or mastoid sinuses were involved; when the scalp was edematous and necrotic; when there was a large scalp defect through loss of tissue; when débridement of the abscess was not as complete as desired. A special form of management was then used which was as follows:

After the usual complete redébridement of the wound and excision of the abscess, the remaining cavity was covered temporarily by means of a graft of fascia lata sutured to the débrided dural edge. This temporary graft and the surrounding bone edge were covered with vaseline gauze, the scalp wound being left open. Penicillin solution could be injected daily through the graft into the site of the abscess. At the end of 15 days, the fascial graft was removed and the underlying brain was prepared for a split thickness graft, which was applied from 5 to 7 days later without disturbing the scalp. Any mobilization of the scalp was avoided in consideration of the subsequent cranioplasty which would also complete the scalp closure.

The temporary dural graft of fascia lata served two purposes: first, it prevented cerebral herniation, and second, it prevented cerebrospinal fluid leakage. Following the débridement of an abscess with disturbance of all the barriers to infection, meningitis may result or diffuse infection may be present at the time of the attack upon the abscess. In either situation, postoperative cerebral swelling, herniation, and fungus formation may result if the débrided area of the abscess has been "exteriorized" without a covering. A pack or drains may be extruded. If the scalp has been closed over such a defect in the dura, there may be extrusion of the brain subcutaneously. The use of a fascial graft as a temporary covering prevents such herniation until the infection is brought under chemotherapeutic control. Leakage of cerebrospinal fluid into the frontal sinuses may also be controlled by the temporary graft, which is removed when the brain has sealed itself about the line of normal dura. A temporary graft was used as it was held to be unwise to bury a fascial graft in an unclean wound, because of the risk of necrosis of the graft and continued wound infection. However, Rowe and Turner (165) have successfully buried fascial grafts in unclean wounds.

Lebendenko (118) reported a mortality of 15.1 per cent in the treatment of 231 patients with brain abscess, and his notation concerning the technique of operation was that "if the walls of the abscess are intact, the abscess is removed 'in toto.'" (David and Ferey [47] found that 24 per cent of 83 patients with fungus died.) Korneansky (114) reported a fatality rate of 18 per cent in surgically treated cases of brain abscess. Bukulov (Russian) (22) reported that 16.8 per cent of the patients with abscess died when treated at a specialized evacuation hospital. The mortality in Ascroft's cases was 25 per cent (25). Webster, Schneider, and Lofstrom (210) found that 27 per cent of the patients with abscesses treated by various methods died. The mortality among those treated by the use of a temporary dural graft (mainly frontal sinus wounds) was 18 per cent.

CONSIDERATION OF WOUND INFECTION, FUNGUS, MENINGITIS

The occurrence of wound infection was observed to be dependent upon several factors. These included the season of the year and the associated weather conditions; the terrain on which the fighting took place; the mobility of the warfare; the speed of evacuation; the number, type, and severity of the casualties; the degree of blood loss; and the extent of the replacement. These influences, and probably many more, such as the number of dressings and the exposure of the wounds, had a bearing on wound healing. It was of interest to compare the incidence of wound infection in patients in the Italian and French theaters with that in a group of German prisoners of war. A high incidence of wound infection occurred in the latter group when certain known factors included (1) late primary wound débridement, and (2) inadequate or incomplete wound débridement. On a rapidly moving front under ideal weather conditions (late summer), the POW patients were treated by the same chemotherapeutic routine as wounded American soldiers. The comparative statistics were as shown in Table II (210).

The comparison warrants the conclusion that the prime factors in preventing infection are early and thorough wound excision. Cairns (27) found

TABLE II.—WOUND INFECTIONS

	Italy			France			German POW		
			Per cent			Per cent			Per cent
Wound infection—total cases	29	146	19.8	27	114	23.6	26	40	65.0
Wound infection—cases with dural penetration	27	119	22.6	21	79	26.5	19	29	68.0
Brain abscess	17	119	14.2	15	79	19.0	10	29	34.4
Incidence of retained bone fragments	16	119	13.4	25	79	31.9	—	—	——

that in "fresh" cases, operated on by neurosurgeons, the incidence of postoperative intracranial infection was only 3.7 per cent. Rowe and Turner (165) have reported that "approximately 15 per cent of the head wounds showed some degree of infection." Slemon (178) found an infection rate of 12.9 per cent. Plans for wound care must be designed to meet the complications arising from delayed and hasty débridements. The average time interval between wounding and operation was 27.6 hours (maximum 5 days—minimum 6 hours) in patients reported by Slemon (178). The importance of wound infection to late sequelae has been shown by Ascroft (7).

Although fungus of the brain was a frequently encountered condition (210), this complication did not constitute the problem which it appeared to present in World War I. By means of chemotherapy, a spreading encephalitis was controllable and fulminating cerebral swelling and extrusion of the cerebral tissue was prevented. The streptococcus organism responsible for rapid and fatal infections in World War I was particularly vulnerable to sulfonamide and penicillin therapy. Cairns (27) reported that the staphylococcus aureus is a frequent wound contaminant, proved by the bacteriological examination of wounds during the Sicilian campaign. The Russians (25) found that only 2 of 300 head wounds were sterile and that a large proportion of deaths were due to anaerobic pathogens (Report by a Committee of Soviet Scientists, 1943 [25]).

The principle of closing the dura following primary wound débridement prevented postoperative herniation. Instances of extrusion of the brain with a separated and infected wound were frequently the result of an underlying cerebral abscess. Relief was obtained after excision of the fungus and total débridement of the associated abscess, usually pocketed under the extruded mass.

A meningitis which may have been present was usually completely controlled by means of continuously administered penicillin or sulfadiazine therapy. Exception to this occurred when the invading organism was drug resistant, being then usually of a gram negative type (Friedlander's bacillus). An unsubsiding meningeal infection was also found in the presence of a cerebral abscess which sustained it.

On failure of a patient to improve normally following primary débridement, with clinical evidence of infection as the cause of the failure, three steps were taken: the chemotherapeutic program was revised to meet the new demands; efforts were directed at proving the presence of an abscess, and cultures were made of the cerebrospinal fluid (210).

SULFONAMIDE AND PENICILLIN THERAPY, AND BLOOD LOSS REPLACEMENT

Both sulfadiazine and penicillin were used in the treatment of the cases presented by Webster, Schneider, and Lofstrom (210). Those patients who were observed in the Italian Theater were, in the main, treated with sulfadiazine, while those in the French Theater received penicillin. The incidence of wound infection in each series of cases did not vary significantly, being 19.8 per cent and 23.6 per cent respectively. Of the group of patients with cranial wounds complicated by brain abscesses, the first 15 were treated with sulfadiazine (penicillin being used only when sulfadiazine failed to control the infection). The latter 18 were, in general, treated with penicillin. An appraisal of the results (mortality) based upon the type of chemotherapy employed showed that in the group of 15 cases treated with sulfadiazine, 4 deaths occurred. Penicillin also failed to control these fatal infections when used after the inefficiency of sulfadiazine was apparent. Among the

TABLE III. THE RELATION BETWEEN EPILEPSY AND WOUND SEPSIS

	Number of Cases	Number with Fits	Per cent of Fits
Wound healed in 15 days	59	13	22
Wound healed in from 15 to 60 days	59	22	37
Wound unhealed after 60 days	58	26	45

18 patients who received penicillin, 5 deaths resulted. Three of the 18 patients were given sulfadiazine treatment when the penicillin failed, and all presented favorable outcomes. In this limited analysis, an outstanding difference in the effectiveness of these drugs did not seem to exist. Others have observed the superiority of penicillin (89). Slemon (178) observed an incidence of infection of 31.2 per cent in 32 patients treated by the local application of sulfathiazole, while the rate decreased to 9.2 per cent in 184 cases treated locally with penicillin and "a sulfa drug." In both groups sulfadiazine was used systemically. Pilcher (154), in over 1,000 experiments, has studied various aspects of the chemotherapy of intracranial infections. Among many observations, the following are the most significant:

1. "Sulfathiazole may produce severe or even fatal convulsions when applied to the brain and should never be used. (Contrary to clinical experience of Cairns [25].)

2. "Experimental staphylococcal meningitis was markedly benefited by oral sulfadiazine, but not by oral sulfathiazole.

3. "Penicillin, when given intravenously, was ineffective in staphylococcal meningitis, but when given intrathecally, it greatly reduced the mortality rate.

4. "Penicillin given intrathecally in normal dogs produced variable degrees of mild irritation and pleocytosis in the cerebrospinal fluid, apparently dependent largely upon the amount of impurity in the preparation of penicillin.

5. "The healing of open cerebral wounds contaminated with staphylococcal organisms has been augmented by the local use of sulfadiazine, but was apparently unaffected by local sulfathiazole or local penicillin. (Contrary to clinical observations.)

6. "Chemotherapeutic agents given systemically have benefited experimental cerebral abscesses only in so far as associated meningitis, if present, was benefited. In other words, our experiences indicate that such drugs probably do not gain access to well-encapsulated infection of the central nervous system."

The use of either drug, it appears, is effective only in proportion to the thoroughness with which the source of the infection is irradicated by surgical measures.

Blood replacement must be recognized as an important factor contributing materially to the control of infection and the production of satisfactory wound healing. A lowered hemoglobin and hematocrit were frequently encountered in spite of previous transfusions in forward installations, particularly in patients with associated injuries. The latter occurred in 36 per cent of one group of patients with cranial wounds (136), and in 28 per cent in another series (27). Upon admission to the general hospital, liberal use was made of whole blood transfusions. Secondary operations were performed after normal levels were established and further replacement was continued as needed. German prisoners were observed to have a secondary anemia greater than that found in the American wounded, and this may have been an added factor related to the common observation that wound healing in the former group was notoriously poor.

Summary and Results

Comparison of the types and results of treatment in groups of patients with war wounds requires qualification as to the point in evacuation where the observations were made. The highest mortality of cranial wounds occurs on the battlefield itself. Little information exists as to the character of these early fatal wounds. The nearer the front line, the higher the mortality (25). The casualties who survive wounds for at least 8 hours reach evacuation hospitals, field hospitals, or similar units for definitive surgical treatment. Death serves to process the wounded during the early hours of injury. The greater number of neurosurgeons available in the American army resulted in the performance of operations upon severe and extensive wounds. In other armies the "more hopeful" of the "bad" (178) lesions were operated upon after minor injuries with absent or minimal neurological signs and then the more severe penetrating wounds, in order of their severity, were treated. Some observers (24, 130, 138) have pointed out that the purpose in the neurosurgical treatment of cranial wounds of war is not lifesaving, but the prevention of infection in survivors of such wounds. The process of primary débridement, toward that end, which is usually performed in the Evacuation Hospital, is none the less associated with a significant mortality. Secondary débridement at a General Hospital, again in survivors, is also attended by an occasional death. Any evaluation must, therefore, be made only in consideration of the corresponding time and place relationships, and the type of cases selected for operation. This is strikingly true in a review of penetrating wounds of the brain in civilian life. In this class, one-half of the patients who are brought to the hospital die within 6 hours of admission.

Information is now available concerning the care of cranial wounds of World War II at Ameri-

TABLE IV.—CRANIAL WOUNDS AND THEIR MORTALITY IN WORLD WAR II

Author	Scalp Wounds	Mortality Per cent	Fracture Dura Intact	Mortality Per cent	Dura Penetration	Mortality Per cent	Infection Dural Penetration Per cent	Death from Infection Per cent
Ascroft (1943)	85	0	139	1.5	292	15.0	8.5	10.8
Eden (1943)	139	0	69	1.4	102	23.0	5.0	3.7
Haynes (1945)					343	12.8		
Cairns (1944)	459*	.65			506	16.4	3.7	
Lebendenko (1943) (Russian)					719	12.5		
Munslow (1945) (140—77% dura penetration)						17.0		
Gaynor and Gurwitz (1945) (156—dura penetration 137)						10.8		
Schorstein (1943)					112	13.4		Low
Sorgo (1942) (German)					29	44.8		34.5
Slemon (1945)					217	14.7	12.9	6.4

*Wounds of scalp and skull.

can evacuation hospitals and at British casualty clearing stations or mobile field units. Table IV summarizes reports which have appeared in the recent literature.

The following patients with war wounds considered in this review were observed by Webster, Schneider, and Lofstrom after reaching a general hospital, having, in most instances, been previously operated upon at evacuation hospitals. Most had survived their injuries and operation for from 5 to 10 days. There were 198 patients with penetration of the dura and brain and 62 with compound fractures in which the dura escaped penetration. Forty German prisoners of war have not been included in the statistics except in the summary of orbitocranial and cerebellar wounds. There were 84 patients with wounds of the scalp requiring neurological observation. The mortality was 6.4 per cent among 260 patients (Italy, 146 cases, mortality 6.8%; France, 114 cases, mortality 6.1%). The wounds were caused by shell fragments in 75 per cent of the patients and by bullets in 14 per cent; in 11 per cent the cause was unknown. A summary, made in several groups and based upon the type of management required in treatment rather than upon the type of pathological damage produced, is given as follows:

Wounds of the scalp (*84 cases—0 deaths*). The patients in this group reached the general hospital usually because of a significant degree of persistent headache which warranted further rest and observation. Wound infection occurred in 15.4 per cent of these patients, which delayed early return to duty. Pneumoencephalograms were taken of 8 patients who presented symptoms and signs suggesting subdural hemorrhages. None was found. It was not unusual for patients in this group to require neuropsychiatric attention, their complaints being due to psychoneuroses.

Wounds without dural penetration (*62 cases—1 death*). The dura was inspected at the time of the removal of the depressed bone fragments in all but 11 of this group of patients. Extradural hemorrhages were found in 3, and subdural hemorrhages in 2; 1 of these patients manifested the complication by Jacksonian convulsions. Four patients presented major neurological disability; in 3 of these the dura was observed to be normal. One patient died, trephining being done at the time of failure. Autopsy showed that death was due to diffuse intracranial injury. An encephalographic study was made of 1 patient in this group. Trepanation at the site of a linear fracture was not routinely performed, although it was said to be of value by Haynes (89).

Wounds with dural penetration (*198 cases—16 deaths*).

The management of wounds with varying degrees of dural and underlying cerebral injury followed in general the principles outlined in the operative technique of primary débridement previously considered. Almost routinely a graft of

	Cases	Deaths
1. Wounds with indriven bone fragments	77	2
2. Gutter type wounds	21	1
3. Wounds with retained bone fragments plus metal	76	3
4. Ventricular wounds	11	2
5. Perforating wounds	8	5
6. Venous sinus wounds (included in other groups)		
7. Bursting fractures	5	3

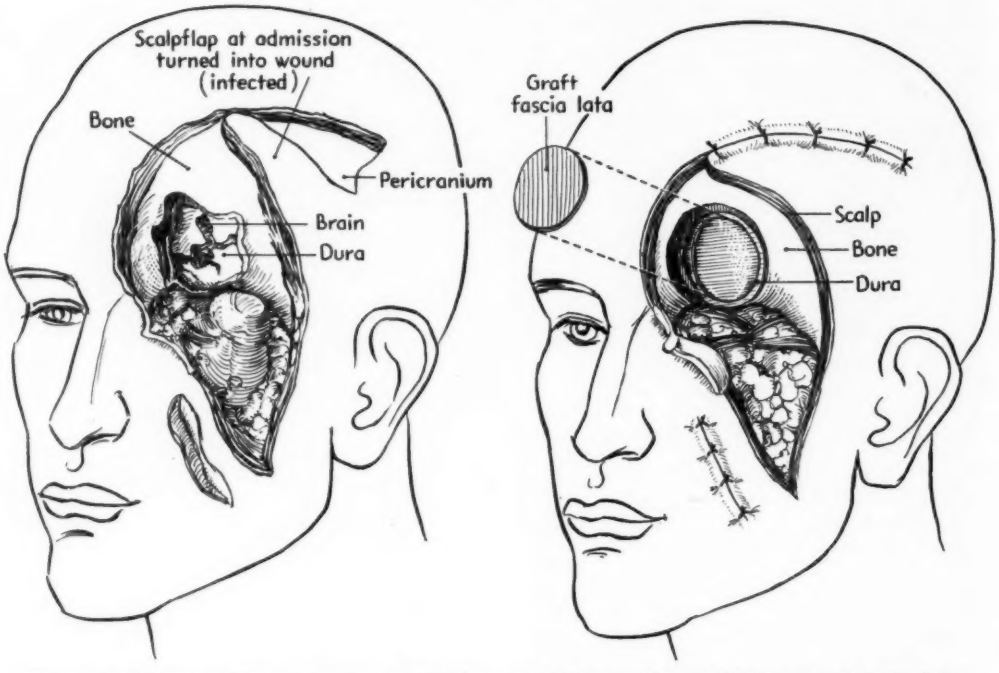


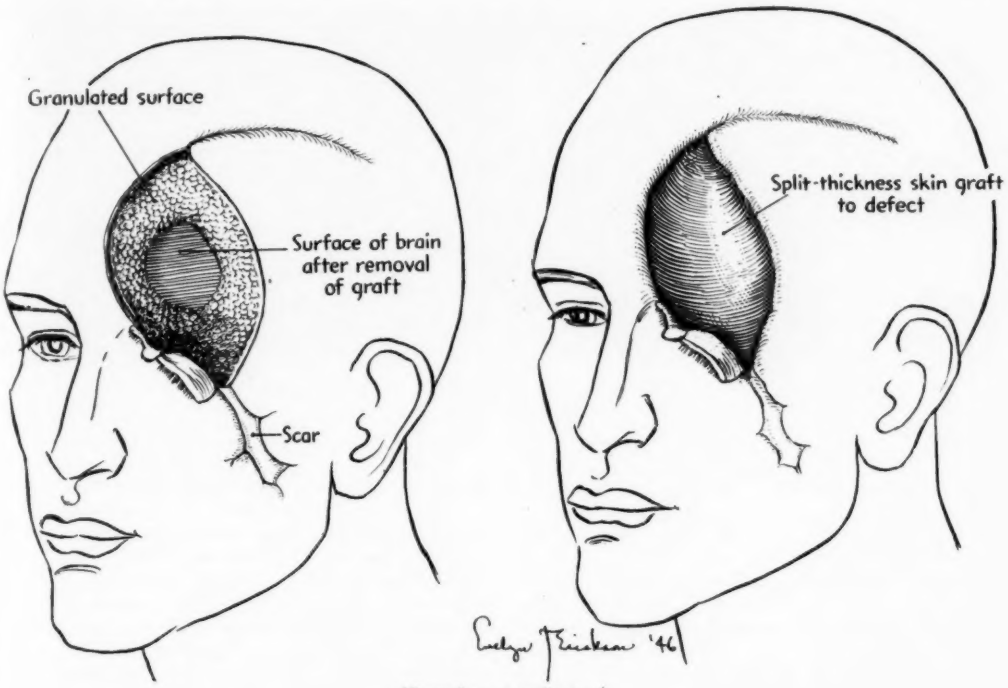
Fig. 5. An illustration of the management of a massive orbitocranial wound by means of a temporary graft of fascia lata followed by a split thickness graft to the defect.

pericranium, temporal fascia, or fascia lata was used to close the dural defect when necessary. For example, the dura was closed in all but 2 cases of the 50 cases in this group, the condition in these 2 cases not permitting further expenditure of time at operation. Among this group of 50 cases, a "preserved" dural graft was employed in 5 patients. The dura was obtained from cadavers and preserved in formalin and then alcohol (177). The observation of "damming back of infection" when closure of the dura was employed, as reported in World War I, was not made.

Patients with gutter type wounds almost uniformly sustained massive anatomical damage to the scalp, skull, and brain. This type of wound was less commonly observed, probably because of the fact that survivors were less frequent. The observation that the pathway for infection is maximum is supported by the fact that brain abscess developed in 9 patients of this group, an incidence of 43 per cent. The policy of tight closure of all wounds at primary débridement regardless of the degree of infection, contrary to that of World War I in which the wound was left open for free drainage, appears to be well founded. It is of interest that relaxing incisions were not employed in the care of gutter wounds with major loss of scalp. Closure was effected, when mobilization of the scalp failed, by means of a flap swung into the craniotomy site, and a bare area of pericranium was left for grafting.

The depth of track damage was usually greater upon penetration by a metallic missile. The potential contamination was also greater because of the fact that fragments, especially those larger than 1 centimeter, bore organic material upon their surfaces. This was true particularly of ragged missiles in contrast to smooth bullets. Shell fragments may be covered with tiny bone particles adhering to the surface. The threat of later complications would appear to be considerable when such fragments are retained. A policy of removing all accessible metallic, as well as bone, fragments was followed when such missiles had not been removed at primary operation.

Survivors of wounds involving the ventricles were infrequently encountered. Contrary to the observation in World War I, opening of the



(*Legend on opposite page*)

ventricle per se in the course of débridement did not significantly increase the mortality probably because of the protection afforded by chemotherapeutic substances. Control of infection was possible, even when the ventricle was entered in the course of débriding a complicating cerebral abscess.

Few patients with perforating wounds survived. The principles in management were similar to those for the less severe penetrating injuries. The wounds of exit, entrance, and of the entire track were débrided. The dura was closed by means of grafts if necessary. Only 1 patient was found to survive a perforating injury involving both hemispheres which had been caused by a small shell fragment.

Venous sinus wounds requiring heroic efforts directed at hemostasis, ligation, muscle grafts, and fibrin foam were sometimes encountered. Adequate exposure was of importance. Money (130) believes that the outlook for a return of cerebral function is "bad" when the sagittal sinus has been completely torn across and requires ligation. We have noted complete neurological recovery in ligations up to the "rolandic point," as has been previously observed by Cushing.

Orbitocranial wounds (*40 cases—5 deaths*). The cases placed in this group were limited to those which involved the orbit and the frontal area of the skull, and they were considered separately in view of the special type of management often necessitated. The management of this group of wounds has been reviewed in detail (211). The injuries of this type numbered 40 and were divided into two groups—Group I, numbering 20 patients who presented severe destructive anatomic injuries to one or both globes in addition to the skull and brain injury; Group II, also numbering 20 patients, but these presented wounds which involved the orbit and brain with varying degrees of physiological injury to the contents of the orbit. Massive wounds involving the orbit and frontal area with associated injury to the paranasal sinuses could not be treated by conventional methods of débridement and closure because of the loss of tissue. A suitable method for treating this type of injury was the employment of a temporary graft of fascia lata to close the dural defect. The graft was removed after 15

Fig. 6. Fan blade injury of the right frontal lobe. A 22 gm. intracerebral clot was removed from the missile track. The injury was caused by a broken off blade of an automobile fan connected to a 110 volt circuit and consequently running at a much higher speed. There was no immediate post-traumatic unconsciousness. About 4 hours after the accident the patient became comatose, undoubtedly because of the enlarging blood clot in the missile track (81).

days and a split thickness graft was then applied to the granulating area of involvement (Fig. 5). Particular attention was given to the total débridement of the sinuses by removal of all devitalized tissue, bone fragments, clots, and sinus mucous membrane. Schorstein (171) recommended radical débridement in wounds of the fronto-orbital region and the employment of a soft paraffin gauze pack in the open wound. A plaster-of-paris skull cap was then used as a routine dressing.

An osteoplastic flap used for exposure of the frontal fossa was found to be of value in wounds with penetration produced by small metallic fragments which entered the orbital roof and the frontal lobe at the base of the skull. This exposure allowed débridement at the site of the bony injury and of the brain, as well as the repair of the dura either by suture or graft. Distortion of the frontal area through loss of bone was thus avoided. In 5 of the 40 cases in this group, brain abscess developed, an incidence of 12.5 per cent.

Wounds involving the cerebellum (10 cases—1 death). It was observed that wounds of the cerebellum were infrequent. Ten cases (an incidence of 3%) were encountered (212). World War I reports indicate an even lower percentage of .54 (6 cases in 1,108)—(127). In 9 of the 10 patients the wounds were located on the left side of the cerebellum, and they were caused by shell fragments in all except 3 cases. In 3 instances the wound of entrance was located in the neck and the associated cerebellar injury escaped attention. The infrequency of cerebellar wounds is probably due to a low incidence of survival among patients with wounds involving the posterior portion of the brain. Other factors probably include the protected anatomical location of the cerebellum and the adequate covering afforded by the steel helmet which was available in World War II. This type of injury, which presents the possibilities of rapid and serious complications, demands exploration as early as possible and is thus a problem for the evacuation hospital neurosurgeon. There was 1 death in this group of patients; 8 presented minimal neurological defects.

Military Civilian Correlations and Conclusions

In civilian practice bullet wounds constitute almost all of the high velocity injuries; in military experience only 15 per cent of craniocerebral injuries were caused by bullets, as seen in a general hospital, and while wounding by shell fragments is unknown in civilian practice, 75 per cent of the cranial cerebral wounds in war belonged in this class (210). The majority of bullet wounds in military practice are fatal because of the velocities and size of the missiles. Most bullets for war use are encased in a metallic casing and have a pointed nose. A great many of the civilian bullets are round nosed. Frequent fragmentation and dispersion of fragments through the area of impact are common with the latter. In view of the lower velocities in civilian bullet wounding, radial acceleration about the track in the tissues is not as marked and therefore there is less pulping at a distance from the track.

Among the low velocity penetrating wounds of the head are perforation by knife blade, car door handle, golf stick, umbrella end, brick, and various other everyday objects. The management of

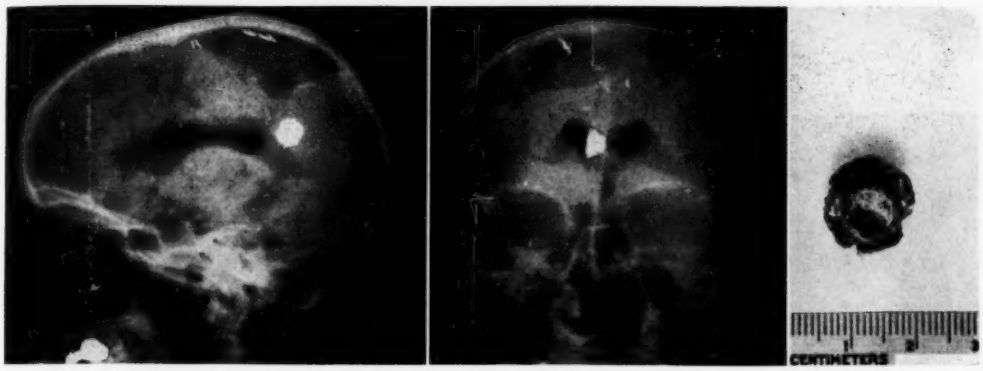


Fig. 7. Bullet wound of head seen two years after trauma for headaches. Examination showed choked discs and evidences of motor irritation in left lower limb. Suspected cyst about bullet was disproved by air encephalograms. The first operation consisted of decompression and tapping for a possible cyst. Decompression was thought sufficient but this only cured the complaints. The area of decompression grew to massive size. A second operation was done for removal of the bullet. The removal was followed by subsidence of the pressure signs. Apparently the bullet behaved like a brain tumor and cure could not be effected without its removal (82).

such wounds deserves only a passing comment. Aside from the possibility of injury to the blood vessels with consequent formation of mass lesions (81), low velocity penetrating wounds of the brain do well under conservative management by careful débridement of the wound of entrance and inspection of the skull and dura. If the fragment is still in the cranial cavity it is removed. Obviously pulped and necrotic tissue is sucked away. No extensive track débridement is necessary, but with lacerations of the brain the possibility of intracerebral hemorrhage should be kept in mind. The removal of large clots from the area of wounding may be lifesaving. In Figure 6 are seen the x-ray films of the skull of an adolescent youth. A broken-off fan blade is seen in the right frontoparietal region near the midline. Although conscious on admission, within 2 hours he became semiconscious, and before operation he was comatose. Following the removal of the fan blade, a 22 gm. intracerebral clot was evacuated from the missile track. The patient awakened within a few minutes while on the operating table. Usually low velocity penetrating wounds, if seen in the acute stage, do well, but careful observation for complicating meningitis and/or brain abscess is recommended. In the cases in which a patient is seen several months or years following a penetrating wound of the head with the foreign body still in the brain, the fragments should be removed since the possibility of eventual infection about the foreign body is ever present. Dretzka (56) reports an instance of brain abscess about a broken knife blade in the left occipital lobe, the injury having been sustained 10 years previously. The abscess and the broken knife blade were removed and the patient recovered. There is no valid reason that easily accessible foreign bodies should not be removed even if they are asymptomatic.

Penetrating craniocerebral wounds of civilians by bullet and low velocity missiles have been the basis for only a few articles since World War I. The reviews by Hanson (86, 87), Pilcher (152), Walker (207), and the articles by Coleman (38), Goode (73), Gurdjian and Buchstein (82), and German, Brody, and Harvey (69) complete the American list. Goode (73) discusses the cases seen in the Cincinnati General Hospital. Of 105 gunshot wounds of the head, 96 presented dural penetration, and a mortality of 80.3 per cent resulted. All of 34 patients with perforating wounds died. In 2 patients retained bullets caused no symptoms, for a 10 year period in one and an eighteen month period in the other. Thirty-one patients were operated upon with a mortality of 45.1 per cent. Goode suggests excision of the wound, of fragments of bone, and of the foreign bodies if possible. A fascia lata transplant is recommended for dural repair. Gurdjian and Buchstein (82) reviewed cases of gunshot wounds of the head treated at the Detroit Receiving and Grace Hospitals. Of 45 patients 11 had no fracture of the skull, while 34 had fracture of the skull and penetration of the dura or both. Among the group with no fracture, 1 had a left parietotemporal subdural hematoma. Of the 34 with fracture of the skull and penetration of the dura, or both, 16

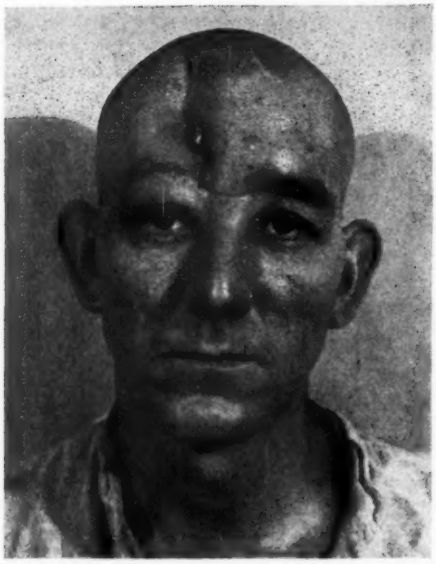


Fig. 8. This patient presented a cerebrospinal rhinorrhea associated with meningitis, cortical ulceration, and an infected wound. Management consisted of secondary débridement with closure of the dura by means of a temporary graft of fascia lata, which was removed later. The open wound was subsequently covered with a split thickness graft.

died in 9 hours or less and 5 died in 26 hours or less. It was concluded that the state of consciousness is of prognostic significance in this class of patient. These authors group their cases into three classes: first, unconscious and moribund; second, semiconscious and responsive to stimuli; and, third, conscious. In the first group all died within a few hours after entrance into the hospital. The patients in the second group carried on long enough to develop evidences of increased intracranial pressure, hyperthermia, and hyperpnea. An initially low pulse rate was usually followed by a rapid, thready pulse. Five of this group died in 26 hours or less after entrance, 1 patient lingered on for 5 days, and the other recovered. Among 11 patients who were conscious on entrance, 9 recovered and 2 died, 1 having refused operation. These authors similarly suggest early operation for débridement—removal of bone fragments, pulped brain tissue, and metallic fragments if possible. German, Brody, and Harvey (69) review a group of compound craniocerebral injuries. Of 64 patients, 9 had bullet wounds of the head; 6 died, 1 before operation. All traversing wounds terminated fatally.

In the preparation of the present review, 100 cases of dural penetration by bullets were reviewed from the records of the Receiving and Grace Hospitals for a period of 20 years. Eighty-three patients died; 63 died in less than 12 hours, 9 additional died in 48 hours or less, and the remaining 11 carried on from 2 to 42 days. The prognostic importance of the state of consciousness was again evident. It seems fair to state that among the 11 who survived from 2 to 42 days, timely and total débridement might have saved some lives.

In comparing military and civilian experiences, the mortality from bullet wounds of the head in civilian life seems appalling. One reason for this high mortality is that most civilians who survive the immediate injury reach a hospital before death, while in military practice comparable cases are seldom seen at an evacuation hospital because of the lack of equally rapid transportation.

It appears that the proper management of penetrating wounds of the brain by high velocity missiles was well worked out at the conclusion of the last war on theoretical grounds. During World War II, with the help of better trained personnel, and the necessary instruments for proper operative intervention, a practical demonstration of what could be accomplished was given. A thorough débridement, removal of all foreign organic matter, and removal of all pulped brain tissue was accomplished in many instances with no sequelae of infection weeks or months later. The use of chemotherapeutic or biologic agents to fight infection has undoubtedly been of inestimable value, but they alone and without careful débridement would have failed. In the following few paragraphs the management of civilian craniocerebral bullet wounds is considered, as well as the lessons learned from war wounds which may be applicable to civilian practice.

Unless a patient with a bullet wound of the brain is in a moribund state on entrance, all effort should be made to give supportive and resuscitative treatment. It is probably true that little can be accomplished for those who will die within a few hours of the injury. For some of those who resuscitate, operative management to remove blood clots from the bullet track with careful débridement may be lifesaving. The importance of careful and complete débridement cannot be overemphasized for upon it depends the prevention of late sequelae in the form of meningitis and/or brain abscess. Long curved incisions may be used to expose the skull defect, and the bone may be ronguered away rather than removed en

masse to expose the dural defect. Careful débridement of the dura, brain, and the track are then carried out with the aid of suction. The electrocautery is used for hemostasis. The use of fibrin foam or cellulose cotton with thrombin may be indicated in some cases. The dural defect is repaired with fascia lata or temporal fascia. The value of whole blood transfusions during the operation cannot be overemphasized.

Metallic foreign bodies in the cranial cavity should be removed whenever possible. There is no reason for leaving them in the cranial cavity if they are easily accessible. Foreign bodies which have lodged in the cranial cavity for many months or years, such as broken knife blades or ice picks, should be removed. An inaccessible bullet which may remain asymptomatic for many months or years may eventually cause symptoms necessitating operative removal (Fig. 7).

There is a difference between civilian and military forms of brain abscess. Simple "drainage" of a brain abscess following a gunshot wound is seldom successful. Excision of the abscess, fragments of bone, hair, and other foreign material is mandatory if a good result is expected. Civilian abscesses can be drained with success (40, 72, 167, 172). There is some evidence to show that late sequelae following civilian abscesses cured by drainage are fewer and less serious than those occurring after the abscess has been excised or allowed to extrude (42, 74). However, radical attack of civilian brain abscesses is advocated by King (112, 113), Kahn (111), Vincent (201, 202), Pennybacker (148), and others. Vincent taps the abscess and later excises it like a deep seated expanding lesion. In civilian practice, the location of the abscess may be important for deciding on the type of management (drainage or excision). Excision may be more seriously considered in the silent portions of the brain, but if an abscess were located immediately beneath the motor centers, drainage with cure may result in less disability.

In an earlier article on cerebrospinal fluid rhinorrhea due to trauma, the present authors (83) discussed the seriousness of cases with complicating brain abscess and meningitis. Excision of the abscess in such a case, and exposure of the fistula and repair (fascial transplant if necessary) can be entertained seriously in a manner described for military cranio-orbital wounds by Webster, Schneider, and Lofstrom (210) (Fig. 8).

With the aid of chemotherapeutic and biologic agents, early, careful, and complete débridement becomes a well established procedure in craniocerebral bullet wounds both to minimize posttraumatic infection and occasionally to save life.

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ABSTRACTS OF CURRENT LITERATURE

SURGERY OF THE HEAD AND NECK

HEAD

Lubschitz, K.: Adamantinomas of the Jaw, with Reference Especially to Their Treatment. *Acta Radiol.*, Stockh., 1945, 26: 441.

Adamantinomas are epithelial tumors which occur chiefly in bones, and especially in the jaws, the lower jaw being affected more frequently than the upper. Though the tumor is benign histologically, it often proves clinically malignant, because of its particular features. It may recur despite repeated surgical intervention and may be responsible for a fatal outcome.

In the jaw, at least, adamantinomas occur a little more frequently in women than in men. Most often the tumor develops between the ages of 20 and 40 years, but it has been found as early as at birth and as late as at the 76th year of age. Its growth is slow, and in the beginning it does not give rise to symptoms; but as it increases in size it causes the bone in which it is situated to expand. This first interferes with chewing; later, deglutition and respiration may become difficult, there may be pain and hemorrhages, perhaps spontaneous fracture. Owing to the slow growth, however, it may often be several years before the symptoms become so marked that the patient finds it necessary to consult a physician.

Morphologically, two forms of adamantinoma may be distinguished: solid and polycystic. The former is the rarest. The etiological connection between the adamantinoma and the enamel organ is shown by the similarity of the microscopic structure.

Operative removal of the tumor has been practiced ever since its nature was recognized. Both enucleation, cauterization, and resection of the portion of bone containing it are mentioned in the literature.

The author gives an account of 11 cases of the disease. The patients were treated at the Radium Center, in Copenhagen, during the period from 1932 to 1943. Seven of the patients were males and 4 were females. In 7 patients the tumor was situated in the upper jaw, and in 4, the lower jaw. Eight of the tumors were cystic, 3 were solid; the latter occurred in the 3 youngest of the patients.

The roentgen examination is an important aid in the diagnosis, which, especially in tumors of the lower jaw, may often be established with considerable certainty on the basis of the roentgenologic picture. In the film the tumor appears as a well defined rarefaction, or as several more or less confluent rarefactions, which often cause expansion of the bone. In the upper jaw the picture is less characteristic; the tumor often (at least in the beginning) shows itself only by a blurring of the maxillary sinus, sometimes by an expansion of the latter, and only after some time do also signs of destruction of the bone appear. Only the histological examination, after biopsy or operation, makes the diagnosis absolutely certain.

The author discusses the therapeutic results and stresses the clinical malignancy of the tumors, as contrasted with their histological benignity. She points out that the clinically malignant character of adamantinomas makes complete primary removal important—in the case of solid adamantinomas, by enucleation, and in the case of cystic adamantinomas, by resection. Roentgen treatment can only be used as a palliative measure.

JOSEPH K. NARAT, M.D.

EYE

Kekcheev, K. K.: Methods of Accelerating Dark Adaptation and Improving Night Vision. *War Med.*, Chic., 1945, 8: 209.

The author discusses methods of accelerating the dark adaptation of the eye with the view of improving night vision. Methods include (1) regulating the adaptation before passing into darkness; (2) wearing goggles with colored lenses; (3) exposing the eyes to white light; (4) exposing the eyes to red light; and (5) employing gustatory and olfactory stimuli. These methods are not equally valuable. The choice of method used depends on the circumstances at the time of adaptation.

HUNTER H. ROMAINE, M.D.

Hardy, L. H., Rand, G., and Rittler, M. C.: Tests for the Detection and Analysis of Color Blindness; An Evaluation of the Ishihara Test. *Arch. Ophth.*, Chic., 1945, 34: 295.

In this article the author and his coworkers evaluate the Ishihara test. They believe that the test is a gross one for defective red and green vision but fails to classify the type of color vision. For this reason it cannot be used to give a satisfactory evaluation, no matter how carefully it is administered.

HUNTER H. ROMAINE, M.D.

Shapland, C. D.: Two Cases Showing Unusual Intraocular Foreign Bodies. *Proc. R. Soc. M.*, Lond., 1945, 38: 663.

In this article the author describes 2 unusual cases of intraocular foreign bodies; one of which showed the possibility of the retention of nonmagnetic metallic fragments in the eye for five years with no evidence of inflammatory complications and no evidence of degeneration from chemical action. In the second case the eye retained multiple particles of

stone without evidence of pyogenic infection. The absence of this infection apparently is due to sterilization of the particles by the heat resulting from the explosion at the time of the accident.

HUNTER H. ROMAINE, M.D.

Struble, G. C., and Kreft, A. J.: War Injuries of the Eyes and Visual Pathways. *War Med.*, Chic., 1945, 8: 290.

The authors discuss the factors leading to eye injuries in warfare and the type of injuries sustained, and illustrate the various forms encountered. They note that serious lesions of the eyes, including macular disturbances, may be caused by blast concussion alone, without any penetrating injury. Penetration of the orbit by minute shrapnel fragments which do not penetrate the globe may also cause serious intraocular damage. No cases of ocular injury following severe war traumas of the mandible were encountered, and the authors believe it possible that the temporomandibular joint may absorb some of the concussion. Severe unilateral facial wounds have resulted in damage to the eye of the same side, but never the opposite eye.

All persons who have been exposed to a severe blast or who have incurred war wounds about the head should have a thorough eye examination, especially as to fundi and visual fields. There should also be a complete roentgenological examination of the skull, the facial bones, both orbits, and the optic foramina for evidence of fracture or foreign body.

WILLIAM A. MANN, M.D.

DeVoe, A. G.: Surgery of the Anophthalmic Orbit. *Am. J. Ophth.*, 1945, 28: 1346.

An opportunity to see a large number of anophthalmic sockets in military service has resulted in an analysis of some of the difficulties encountered in the use of a properly fitting prosthesis. The commonest single cosmetic blemish seems to be the retraction or sinking of the upper lid with loss of the normal lid crease. This may be due to a change in the normal direction of pull of the levator, to loss of orbital tissue, to atrophy of the orbital fat, to overlapping of the muscles over an implant with the levator pulled down by the superior rectus, or to use of a large implant, as has been suggested by various authors. It is difficult to overcome this by changing the shape or size of the artificial eye. Attempts to overcome this difficulty have been attempted by (a) severing the attachments of the superior rectus and the levator at the time of enucleation, (b) delayed implantation of a glass sphere, (c) implantation of cartilage on the floor of the orbit, and (d) dermal graft to the upper lid.

The results of the first method are inconclusive. As to the second method, it is often difficult to find Tenon's capsule for delayed implantation, especially under general anesthesia, and in general this method was found unsatisfactory. If there is a depression of the floor of the orbit, cartilage may be implanted subperiosteally. The author has had good success with dermal grafts in these cases. Thick skin from the back is implanted high and superficially beneath the skin of the upper lid, using two layers.

The next most common defect is one which usually occurs after an artificial eye has been worn for many years; there is difficulty in retention of the eye due to a relaxation of the orbicularis. An operation similar to Wheeler's method for shortening the orbicularis in spastic entropion may be performed, and the author used this method in 4 cases, with success in 2. In the 2 cases in which this operation was not successful, the defect was corrected by the use of a mucous membrane graft after dissection of the conjunctival surface below the tarsus.

The author believes that the use of skin grafts in the socket should be avoided because of the resulting discharge and odor, especially where both skin and mucous membrane are present.

The surgical procedures described should be used only after all attempts to correct the defect with a properly fitting eye have failed.

WILLIAM A. MANN, M.D.

Reese, A. B.: The Iridencleisis Operation for Glaucoma. *Arch. Ophth.*, Chic., 1945, 34: 360.

Of 61 eyes upon which the author performed an iridencleisis operation for glaucoma, the disease was arrested in 52, and in 9 the results were considered unsatisfactory. Failure in 2 cases was believed to be due to a poorly placed incision; in the remaining 7, the patients had undergone previous trephine operations or had shown uveal pathology, and were therefore unsuitable for this method of surgery.

The author emphasizes the importance of making the keratome incision in the sclera 2 mm. behind the limbus, and producing an iridodialysis, leaving both iris pillars incarcerated, which suggests some variance in technique from that which is usually employed. He prefers to incise the conjunctiva with the keratome 10 mm. from the limbus, dragging it down to the point of incision in the sclera, rather than to make a clean dissection down to the sclera before inserting the instrument.

It is emphasized, as has been brought out by others, that this operation is most useful in cases in which the intraocular tension is not too high—preferably under 50 mm. Hg. (Schiötz). It is not indicated in cases of long standing, in aphacia, or in cases in which previous operations for glaucoma have been unsuccessful.

The author has encountered no serious complications with the operation, and has thus far observed no instance of sympathetic ophthalmia following it.

WILLIAM A. MANN, M.D.

Muldoon, W. E.: Restoration of Patency of the Nasolacrimal Duct. *Am. J. Ophth.*, 1945, 28: 1340.

The author has placed vitallium tubes into the nasolacrimal duct in 4 cases of stenosis of the duct with a fairly good end-result in at least 3 of the cases. The principal advantage of vitallium is its

lack of tissue reaction; the metal may be left in position permanently, and for this reason it has had widespread use, especially in orthopedic surgery. Doherty first reported its use in ophthalmology as an orbital implant.

The author exposed the lacrimal sac by a 13 mm. curved skin incision, and through a small incision in the sac curetted the nasolacrimal duct and then placed the vitallium tube into the bony canal with the shoulder resting on the rim of the canal. The incision in the sac was closed with ooo plain catgut and the skin and subcutaneous tissues were sutured in the usual manner. A pressure bandage was applied for several days, and the canal irrigated through the upper or lower punctum one or two weeks later.

It was found that in most cases a tube 3 mm. in diameter could be inserted without difficulty. Because the metal is extremely hard it must be cast, and therefore the walls cannot be less than 0.5 mm. in diameter. This inside diameter of 2 mm. seems to be adequate for drainage. The length of the tube is 18 mm., which the author believes to be desirable. In one case, a tube 2 mm. in diameter was used, leaving a lumen of only 1 mm., which does not seem to be adequate.

The author points out the advantages of this procedure over a dacryocystorhinostomy, and the improvement reported in his cases would seem to justify further use of this method. X-ray films of the tube in position are reproduced.

WILLIAM A. MANN, M.D.

Reis, J. L.: A Corneal Graft Operation for Recurrent Pterygium. *Brit. J. Ophth.*, 1945, 29: 637.

The author describes a corneal graft which he uses in association with pterygium operations in order to prevent the postoperative cicatricial opacity with subsequent vascularization which occurs following the general surgical procedure. He believes that the optical and cosmetic results are better, and that there is less likelihood of recurrence. The technique is plainly described. HUNTER H. ROMAINE, M.D.

Krause, A. C.: Congenital Cataracts following Rubella in Pregnancy. *Ann. Surg.*, 1945, 122: 1049.

The author reports 5 cases of congenital cataract which followed rubella in pregnancy, and discusses the preventive, conservative, and radical treatment of fetal rubella.

In Australia an unusual number of congenital nuclear bilateral cataracts appeared as a mild epidemic in infants. Damage to the lens evidently occurred during the first few months of pregnancy in mothers who acquired German measles during the second or third month of pregnancy. The cataracts were associated with many other congenital defects. Mental retardation occurred in 4 infants, congenital deaf mutism in 11, and heart lesions in 21.

In a series of 124 cases reported in the literature in which pregnant women were diagnosed as having rubella, 96 infants had cataracts.

In view of the seriousness of the complications, therapeutic abortion should be considered if the disease has occurred in the first 4 months of pregnancy. Treatment with convalescent serum should also be considered. Krause stresses the importance of early surgical treatment of the cataract, before the ability to develop fixation is lost; this would be before the age of 3 months.

JOSHUA ZUCKERMAN, M.D.

Scholz, R. O.: Epivascular Choroidal Pigment Streaks, Their Pathology and Possible Prognostic Significance. *Bull. Johns Hopkins Hosp.*, 1945, 77: 345.

The author describes 5 cases of epivascular choroidal pigment streaks, rosary streaks of Siegrist, and reviews the literature on this subject.

The majority of the patients considered had hypertensive cardiovascular disease, and in some of them renal involvement was indicated. It was possible to follow up the study in 1 instance with autopsy findings. Anatomical reconstruction indicates that the ophthalmoscopic picture is produced by proliferation of the epithelium over partially sclerosed choroidal arteries. It is suggested that the presence of these streaks is of prognostic value, and in the majority of cases a poor prognosis is indicated.

HUNTER H. ROMAINE, M.D.

Rodin, F. H.: Hypertensive Retinopathy Associated with Adrenal Medullary Tumor (Pheochromocytoma): A New Clinical Entity. *Arch. Ophth.*, Chic., 1945, 34: 402.

Pheochromocytoma is a rare form of chromaffin tumor arising from the embryonic sympathetic nervous system. The adrenal medulla is composed of chromaffin cell tissue, hyperplasia of which is considered the rarest form of adrenal tumor. It is characterized by a train of hypertensive changes, including definite ocular changes. Epinephrine or an epinephrinelike pressor substance is contained in the cells of the tumor. This substance, freed in the bloodstream, causes vasoconstriction, elevation of the blood pressure, and stimulation of the sympathetic nervous system. In the eye there is a typical hypertensive retinopathy.

In a case reported by the author, there was an extensive retinopathy of a hypertensive type with hemorrhage and exudates. These findings disappeared following removal of the tumor. Serial fundus photographs illustrate the findings in the eyes prior to and after removal of the pheochromocytoma.

The author believes that this is a new clinical entity which should be called a hypertensive retinopathy associated with adrenal tumor.

WILLIAM A. MANN, M.D.

Bedell, A. J.: Clinical Differentiation of Emboli in the Retinal Arteries from Endarteritis. *Arch. Ophth.*, Chic., 1945, 34: 311.

The author describes a means of differentiating emboli in the retinal arterial system from endar-

teritis. In cases of embolism the arteries become mere threads and are greatly reduced in size, whereas in endarteritis the arteries are not as small as those found in embolism. In addition, in the latter case there are always white plaques along the walls of the vessel. In embolism the retinal edema is limited to an oval area which includes the disc and macula, while in endarteritis the edema usually involves the entire visible fundus. In cases of endarteritis there is always some evidence of pre-existing arterial disease—increased reflex from the vessels, irregularity of vessel caliber, indentation of the veins, and exudates, hemorrhages, or other signs of arteriosclerosis and hypertension.

HUNTER H. ROMAINE, M.D.

EAR

Henry, G. A.: Blast Injuries of the Ear. *Laryngoscope*, 1945, 55: 663.

In this article are presented the findings and impressions gathered from 292 men sustaining blast ear injuries. These cases were seen during the Battle of Europe at a large hospital part time under canvas and later in buildings. They came chiefly from infantry and armored units.

Tinnitus was the most common and by far the most persistent of the symptoms. It occurred in one ear in 124 patients and in both ears in 48. Usually it lasted for from only a few days to a month, but in a large minority it persisted continuously for from a few months to a year. Vertigo was not a prominent symptom. A few of the men stated that they found blood in their ears shortly after the blast; many more found a slight discharge a day or two later. On examination, however, it was surprising to find how few had evidence of blood in the canal or middle ear.

Headache of the usual frontal, parietal, or occipital variety was occasionally a complaint, but it did not occur more frequently in this group than in a similar number of soldiers without blast ear injuries. One hundred and fifty-two patients suffered perforation of the ear drum; 114 had a single perforation of 1 eardrum; 12 a double perforation of 1 drum, and 26 had a single perforation in both tympanic membranes. Hemorrhagic areas of the drum were present in 36 cases. External otitis was present in 1 ear canal 20 times, and in both ears 22 times.

In the beginning nearly all cases had a combination of conductive and perceptive deafness. The greatest hearing improvement occurred in the first 10 days, most of this in the first 4 days. The majority of cases continued to show improvement in perceptive hearing; a few showed gradual deterioration.

It seemed likely to the author that about two-thirds of the men would recover completely. Others would unquestionably be inconvenienced by loss of hearing in one ear and a smaller group would require the help of a hearing aid. Unfortunately, a few will have so much loss of hearing that they will require instruction in lip reading.

NOAH D. FABRICANT, M.D.

Struble, G. C.: Penicillin Therapy in the Practice of Otolaryngology. *Arch. Otolar.*, Chic., 1945, 42: 327.

The parenteral methods used for the administration of penicillin consisted of intravenous drip for the first 24 or 48 hours in the most severe infections, followed by intramuscular injections every 3 hours.

Local methods of application consisted of the instillation of isotonic sodium chloride solution containing 2,500 units of penicillin per 1 c.c. into the sinuses, ears, and mastoid cavities; the filling of the paranasal sinuses with ⅛ per cent of ephedrin sulfate in isotonic sodium chloride solution containing 200 units of penicillin per cubic centimeter, and the dusting of postoperative mastoid wounds with 100,000 units of penicillin powder.

The following opinions were expressed, supported by illustrative cases. Parenteral penicillin therapy has a favorable effect in acute sinusitis, but is not effective after acute and chronic empyema is present. Local therapy shows great promise in the empyema of sinuses. Penicillin therapy is effective in early stages of otitis media, but must be given in adequate doses over a long period.

Suppuration in the mastoid or petrous pyramid may be incompletely controlled (masked) and cause complications after withdrawal of the drug unless surgical drainage is instituted. Sulfonamide and penicillin therapy should be combined when intracranial extension is suspected.

In chronic otitis media without cholesteatoma or granulations and with a large perforation, penicillin given locally was sometimes useful in controlling local infection.

In cases of superficial cellulitis, in deep infections involving the retropharyngeal, submaxillary, and parapharyngeal spaces, and in Ludwigs' angina, penicillin was found to be more effective than sulfonamides in controlling the spread, but almost invariably surgical drainage was also required. Penicillin, like sulfonamide compounds, can give an effect masking the presence of disease unless the physician is alert to this possibility. The general principles and indications for surgical drainage remain unchanged.

JOHN R. LINDSAY, M.D.

Lindsay, J. R.: Osteomyelitis of the Petrous Pyramid of the Temporal Bone. *Ann. Surg.*, 1945, 122: 1060.

Lindsay states that the middle ear air spaces separate the marrow spaces of the bones of the vault from the petrous pyramid and other bones of the base of the skull.

Infection passes readily from marrow spaces to air cells, but extension in the reverse direction meets greater resistance. The cell system, therefore, tends to limit the spread of osteomyelitis between the vault and the base of the skull.

Osteomyelitis of the petrous pyramid sometimes occurs by the hematogenous route or by extension from other bones of the skull base, but it is usually a direct extension from middle ear suppuration.

The dense labyrinthine capsule forms a barrier between the marrow-containing apex and the middle ear cell system in the majority of bones. In about 20 per cent of bones, however, the air cell system invades the apex and creates a direct entrance for infection and the possibility of osteomyelitis.

A tendency to obstruction of drainage, created by a natural bottleneck, predisposes to the breakdown of cell partitions and invasion of surrounding marrow spaces in the apex.

Osteomyelitis tends to remain localized within the apex during the acute stages and responds well to surgical drainage.

Chemotherapy provides a valuable aid in localization, but cannot be depended upon to cure without surgical drainage.

In the presence of sequestration or extension of the osteomyelitis to other bones of the base of the skull, the combination of chemotherapy and surgical drainage offers a means of avoiding dangerous complications, but may fail to eradicate the disease.

JAMES C. BRASWELL, M.D.

NOSE AND SINUSES

Lumsden, R. B.: War Wounds and Injuries Involving the Paranasal Sinuses. *Edinburgh M. J.*, 1945, 52: 402.

Twenty cases of wounds or injuries involving the paranasal air sinuses are recorded.

In 9 of these the frontal or frontoethmoidal region was involved, while involvement of the maxillary or maxilloethmoidal region occurred in 11 cases.

The late operative procedures are described and technical points are discussed.

JOHN F. DELPH, M.D.

MOUTH

Parker, D. B.: Observations on the Definitive Treatment of Maxillofacial Injuries. *J. Oral Surg.*, 1945, 3: 320.

In examining and reviewing a large number of maxillofacial gunshot injuries or injuries from contact with high explosive missiles in the military hospitals designated as plastic maxillofacial centers, one recognizes certain definite facts. The first observation is in great contrast to the observation of World War I in that the incidence of infection of the soft tissues and bone is much lower. Two or three months after injury, we find comparatively few cases of osteomyelitis or necrosis involving the bones of the face and jaws. This is unquestionably the result of early intelligent treatment in the forward areas. The training of medical and dental officers in maxillofacial surgery, and the assignment of these officers to teams working with the auxiliary surgical groups have certainly borne fruit in the better condition of the wounds when these patients have been evacuated to the United States for intermediate or definitive treatment. The second observation is that there has been a much more intelligent effort to stabilize the bones of the face and jaws in a more nearly normal, anatomic relationship. This has aided in avoiding the deformities resulting from collapse of the bony supporting structures of the face, often difficult to overcome in the definitive treatment. Wiring techniques have been accepted as an aid in primary treatment in the overseas theaters.

The medical officer has learned that the dentist is essential to the ultimate treatment of the maxillofacial injury, just as the dentist realizes that the plastic surgeon is essential to completion of many of the oral operations and the cases as a whole. Mutual understanding as to the part that each should play, and a knowledge of the ultimate requirements in function and appearance, have made the plastic maxillofacial services function to the ultimate advantage of the patient.

When there is a loss of bone in the mandible, an adequate soft tissue bed, in which a bone graft will eventually be placed, is essential. An attempt to insert a bone graft in tense adherent cicatricial tissue will often result in failure. Such tissue should be replaced by tissue having a good circulatory bed and loose enough to accommodate a graft without pressure sufficient to alter its contour. Bony support sufficient to withstand masticatory pressure or to aid in the retention of a prosthetic appliance is desirable before much of the flat surface plastic repair of the face is complete. Bone grafts in areas communicating with the mouth or in which residual infection persists (in the bed or adjoining lost bone) are, of course, doomed to failure, although, with penicillin therapy, some of the implanted bone cells may eventually survive.

One of the most difficult problems attending the definitive treatment of maxillofacial injuries caused by penetrating missiles is the trismus resulting from the wounds adjacent to the coronoid zygomatic temporal area. The marked destruction of the temporal and masseter muscles, as well as of the buccinator muscle, results in a dense fibrosis in this area, which either limits or obliterates altogether the masticatory function of the mandible. Attention should be given both to preventing the maximum amount of fibrosis and to correcting functional disability.

Another problem in the definitive treatment of maxillofacial injuries is that of adhesion of the buccal mucous membrane to the alveolar ridge of the mandible or of the maxilla, which obliterates partially or entirely the vestibule of the mouth. Such a deformity limits the motion of the lips or of the buccal muscles, which results in limited motion of the facial muscles of expression. It also limits the ability of a patient to wear a prosthetic appliance to assist in functional mastication, or for cosmetic use, to improve the contour of the face. Such conditions can be treated only by deep incisions through the adherent cicatrix and the interposition of a split graft over a stent mold held rigidly in position.

LOUIS T. BYARS, M.D.

Cook, T. J., Royster, H. P., and Kirby, C. K.: The Treatment of Gunshot Fractures of the Mandible. *J. Oral Surg.*, 1945, 3: 326.

Certain essential steps should be followed in the treatment of gunshot fractures of the mandible. Control of hemorrhage, establishment of an adequate airway, temporary immobilization of the fractured bone, and treatment of shock are to be considered first. This is followed by minimal primary excision, without suture except when conditions are favorable for primary closure, and early immobilization of the fractured bone. Secondary minimal excision and débridement are done from 5 to 10 days after the injury, accompanied or followed by delayed primary closure of the skin wound. The authors recommend treatment of osteomyelitis by early radical operation. LOUIS T. BYARS, M.D.

McNeely, R. G. D.: Adenolymphoma of the Salivary Glands. *Canad. M. Ass. J.*, 1946, 54: 124.

Five cases of adenolymphoma of the parotid gland are reported. This type of tumor is infrequent, only 2 cases having been found among 125 salivary gland tumors seen in the Toronto General Hospital pathological laboratory in a 10 year period. Only 2 cases of malignancy have been reported in the literature. The tumor becomes apparent as a slow growing mass near the angle of the lower jaw, usually in the fifth, sixth, and seventh decade. Subjective symptoms are absent and the growth is encapsulated and easily removed. It is composed of tall, doubly placed, acidophilic cells which line the ducts and glandlike arrangements into which may project papillae and which may be dilated to form cystic spaces. The epithelial structures are supported by a lymphoid stroma with active germinal centers.

The genesis of the tumor is discussed and reasons advanced in favor of the hypothesis that it arises from salivary duct epithelium. The lymphoid tissue apparently serves as a supporting stroma and appears to participate in the neoplastic process.

JOHN R. LINDSAY, M.D.

NECK

McArthur, J. W., Rawson, R. W., and Means, J. H.: Idiosyncratic Febrile Reactions to Thiouracil; Clinical Characteristics and Possible Pharmacologic Significance. *Ann. Int. M.*, 1945, 23: 915.

Thiouracil was employed in the preoperative preparation of 104 patients suffering from thyrotoxicosis. Toxic reactions (applying the term in the most inclusive sense) occurred in 15 instances. In 5 cases fever was the most conspicuous feature of the reaction. The case reports of 3 patients who developed fever are presented, with speculations as to the fundamental significance of the idiosyncratic response.

The sudden onset of fever after a relatively constant latent period of 10 days, the explosive immediate reaction upon readministration of the drug, and the character of the accompanying symptoms suggest that thiouracil reactions are manifestations of the true drug idiosyncracy. A review of the literature on the nature of thiouracil reactions revealed the fact that attention has been focused on factors which may predispose an individual to develop an idiosyncratic reaction, while the precise chemical factors which render an agent capable of inducing hypersensitiveness have been largely neglected. It is pointed out that the sensitizing capacity of a drug depends upon chemical structure, and that hypersensitivity may be developed to the molecule as a whole or to certain radicals of the molecule. Propensity to induce idiosyncratic reactions is strong presumptive evidence of a drug's capacity to become bound to protein. It is suggested that capacity to bind proteins is the common chemical factor which is responsible for the anaphylacticlike complications of chemotherapy as well as the therapeutic effect. The prevention of thyroid hormone formation by the sulfonamides and thioureas may prove to be due to an enzyme blockade mechanism.

JOHN L. LINDQUIST, M.D.

Keating, F. R., and Cook, E. N.: Recognition of Primary Hyperparathyroidism. *J. Am. M. Ass.*, 1945, 129: 994.

Clinical hyperparathyroidism may be divided into three groups, in accordance with the extent of the skeletal involvement. Group 1 comprises the cases with the classic picture of osteitis fibrosa cystica generalisata; group 2 consists of cases with atypical demineralization of the skeleton, and group 3 includes the cases which showed no skeletal involvement but demonstrated renal calculi. Disease of the bone was demonstrable in 67 per cent of the author's cases. However, renal calculi and calcification were found in 92 per cent of the cases. Classic bone disease seemed to be slightly more frequent in women than in men, whereas renal disease was more frequent in men.

Symptoms of hyperparathyroidism were divisible into three groups in accordance with the chemical changes in the blood and urine, or the degree of involvement of the kidneys or of the skeletal system. Chemical changes in the blood were manifested by an increase of calcium and a decrease of inorganic phosphorus. As a result, the symptoms were muscular atony, weakness, fatigue, and constipation, all of which could be correlated with the degree of hypercalcemia. Polyuria was present in 46 per cent of the cases and was regarded as being due to the excessive excretion of calcium and phosphorus. The latter also provided the basis for nephrocalcinosis. Hyperparathyroidism was suspected in any patient having renal calculi of calcium. Laboratory diagnosis was made on the basis of increased calcium and decreased phosphorus in the serum with a loss of calcium in the urine. Repeated blood determinations were necessary since the elevation of calcium was slight. Thus, in 12 of the 24 cases of hyperparathyroidism the blood calcium averaged less than 12.5 mgm. per cent. Ionic calcium was found to be specifically affected by parathyroid disease while

the organic calcium proteinate was not so influenced. With multiple myeloma or sarcoidosis there was a secondary hypercalcemia mainly in the organic fraction of the blood which accompanied a hyperproteinemia. When the value of serum calcium was equivocal, a low level of inorganic phosphorus, below 3.5 mgm. per cent, served as a good diagnostic clue. Elevation of the alkaline phosphatase was useful as an indication only of bone disease but not necessarily of hyperparathyroidism. Under properly controlled dietetic conditions a strongly positive Sulkowitch test for calcinuria was supportive of the diagnosis of hyperparathyroidism. With the Bauer and Aub diet normal persons excreted less than 100 mgm. of calcium, whereas hyperparathyroid patients lost between 125 and 200 mgm. per day. In groups 1 and 2 demineralization of the skeleton was manifested by pathological fractures, multiple bone cysts, and miliary osteoporosis of the skull. Dental roentgenograms were significant when, in conjunction with other bone changes, disappearance of the lamina dura of the teeth was found. Examination of renal calculi caused by hyperparathyroidism showed a predominance of calcium oxalate.

In all of the 24 cases a parathyroid adenoma was demonstrated at operation. In no case was a diffuse adenomatosis of all parathyroid tissue found. None of the adenomas in this series was in the mediastinum and none was considered malignant. After operative removal, the blood calcium and inorganic phosphorus returned to normal, the former within two days and the latter more slowly. In 50 per cent of the patients tetany, ranging from mild to severe, developed postoperatively. Severe tetany seemed to occur most frequently in those cases which exhibited extensive osseous change and high levels of alkaline phosphatase. Mild tetany was accounted for on the basis of a reverse shift in the calcium and phosphorus which created a temporary period of hypoparathyroidism.

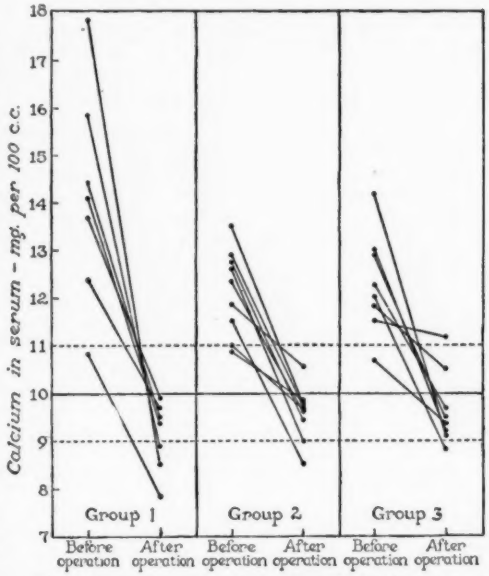


Fig. 1. The changes in the average level of calcium in serum before and after removal of a parathyroid tumor. Each point represents the average of numerous determinations made, in most instances, over a period of several weeks. In 1 case in group 3 no significant change in serum calcium occurred following the operation. The level of inorganic phosphorus and the excretion of calcium were also unchanged, and this has been assumed to indicate that a second tumor is probably present.

B. G. P. Shafiroff, M.D.

SURGERY OF THE NERVOUS SYSTEM

PERIPHERAL NERVES

Sunderland, S.: Traumatic Injuries of Peripheral Nerves; An Analysis of the Incidence in 301 Consecutive Cases of Peripheral Nerve Injuries. *Austral. N. Zealand J. Surg.*, 1945, 15: 25.

The author presents a statistical summary of 301 consecutive cases of peripheral nerve injuries observed in military centers in Australia, during the period from 1941 to 1944. The data, summarized mainly in several charts, give the incidence of injury according to the cause ([1] gunshot wounds of war and [2] lesions due to "other causes"), the location of the injury as to nerve or combinations of nerves, whether the injury was right or left-sided, and whether the injury was complicated by bone injury as well. It was found that plexus injuries predominated on the left; that lesions of the ulnar nerve occurred twice as often as those of the median or radial nerves which were involved in approximately equal proportions; and that in combined lesions the radial, median, and ulnar nerves were affected in equal proportions. In upper limb injuries, single nerve lesions outnumbered combined nerve lesions 6 to 1, and upper limb injuries were three times as numerous as those in the leg. Gunshot wounds of the sciatic nerve were nine times as numerous as those due to other causes. In the gunshot injuries, lesions of the ulnar nerve predominated; also, this nerve was more frequently the common factor in combined lesions than either the radial or median nerve. The commonest cause of peroneal nerve injury was the pressure of a plaster cast.

JOHN MARTIN, M.D.

Sunderland, S.: Blood Supply of the Sciatic Nerve and Its Popliteal Divisions in Man. *Arch. Neur. Psychiat.*, Chic., 1945, 54: 283.

The author studied in considerable detail the gross and microscopic characteristics of the vascular patterns of the sciatic nerve in 40 adult human cadavers, with special attention to the gluteal region, the upper, middle, and distal thirds of the thigh, the popliteal fossa, the neck of the fibula, and the upper, middle, and distal thirds of the lower portion of the leg. He found that the largest arteriae nervorum of the entire body were those supplying the sciatic nerve in the buttock and thigh (Fig. 1). They were arterioles, and they arose from the inferior gluteal artery and the perforating anastomotic chain. Nutrient arteries of the direct type predominated, and these occurred in a T-pattern most commonly when they reached the nerve. The large nutrient vessels were found to enter the nerve directly in most cases, without a long superficial course, in the upper sciatic nerve. In the popliteal fossa the largest vessels ran on or within the nerve, but as the common peroneal nerve approached the neck of the fibula the larger intraneural vessels were found to occupy a superficial and exposed position in 88 per cent of the specimens, and a deep and protected position between nerve fasciculi in only 12 per cent.

Fig. 1. Illustration of a dissection, showing the blood supply to the sciatic nerve from the inferior gluteal artery, crucial anastomosis, and, in particular, the perforating anastomotic chain. The nerve has been displaced medially to demonstrate the latter.

Not only is the peroneal nerve a smaller and less well protected nerve than the tibial, which might partially account for its susceptibility to pressure effects, but it is also usually in the form of one major bundle, so that its vessels have poor protection from outside pressure. Furthermore, the peroneal nerve is poor in supporting and protective adipose tissue. The tibial arteriae nervorum have the added protection that they lie in crevices between several bundles of the nerve.

An excellent table is provided to show the source and number of the nutrient arteries to the sciatic nerve in man.

JOHN MARTIN, M.D.

Barnes, R., Bacsich, P., and Wyburn, G. M.: A Histological Study of a Predegenerated Nerve Autograft. *Brit. J. Surg.*, 1945, 33: 130.

For purely investigative purposes, the authors performed an autograft in a patient with a large and irreparable injury to the ulnar nerve. Seven centi-

meters of the distal segment of the nerve were excised, and were then sutured to the "freshened" distal end of the proximal segment. The graft was 3 millimeters in diameter, and the central segment was 6 millimeters in diameter, so that contact of only about 25 per cent was obtained between the stump and the graft. Three fine linen thread sutures were passed through the sheath of the nerve to effect this contact, and the distal end of the graft was then sutured to the intermuscular septum. There was little or no scarring of the soft tissues in the new graft bed. This operation was performed 613 days after the original injury.

After an interval of 168 days, the wound was again opened and the graft inspected. There was firm healing at the line of suture, and at that point there was a firm fusiform swelling of the nerve. The graft was firmer than at the time of insertion, and it was not unduly adherent to the surrounding tissues. The graft was then stimulated with the faradic current (this operation having been done under local anesthesia), but no sensory response was obtained distal to a point 1 cm. below the suture line. The entire graft together with 2 cm. of the central stump was then removed for histological study.

This autograft was found not to have undergone any central necrosis, and it had provided a pathway for new nerve fibers, some of which were found to have proceeded for 20 mm. beyond the suture line. None of these new fibers were medullated, and the transition from medullated to nonmedullated character took place abruptly and immediately above the suture line. In the opinion of the authors, this absence of medullation may have been due to extensive intrafasicular fibrosis which prevented normal maturation of the nerve fibers. While the new nerve fibers in the graft were neither normal in anatomy or quantity, it was of significance to the authors that such an old, predegenerated autograft could receive nerve fibers after so long a time, and that a central stump still could retain regenerative powers as long as 613 days after the original injury.

JOHN MARTIN, M.D.

BRAIN AND ITS COVERINGS; CRANIAL NERVES

Murphey, J. P., and Gellhorn, E.: Multiplicity of Representation Versus Punctuate Localization in the Motor Cortex; An Experimental Investigation. *Arch. Neur. Psychiat.*, Chic., 1945, 54: 256.

This report of an obviously carefully worked out investigation indicates that there is a multiplicity of motor representation in the cerebral cortex rather than the commonly conceived restricted localization of motor function. In the words of the authors, emphasis is shifted from isolated cortical representation to more inclusive cortical function.

The animals employed in the study were the rabbit, cat, and monkey, these animals being chosen to determine whether or not results of cortical stimulation, executed after an original concept of the authors, could be correlated with the principle of progressive encephalization. Such correlation was, in fact, possible, but to a limited degree, and the broad concept of multiple cortical representation was found to be maintained in this admittedly limited phylogenetic arc.

The authors believe that in stimulating the cortex it should not be subjected to the weakest possible electrical currents, but that the aim should be to evoke as much as possible of the total capacity for physiological response. Under such conditions of cortical stimulation they found that multiple representation of movement is widespread in the motor cortex of the rabbit, cat, and monkey, and that the most common type of multiple representation is that found in the large somatotopic divisions, the leg, arm, and face. The cortical overlap of two large somatotopic subdivisions apparently decreases with progressive encephalization as the phylogenetic scale is ascended. The point is made that it is movements, not muscles, which are much more widely represented than the usual cortical maps would indicate. Movements involving distal joints were not found to be more widely distributed than movements involving the proximal joints.

The authors believe that this multiplicity of representation and the extent of representation of movements beyond the bounds ordinarily determined by threshold stimulation probably account for the recovery of function of individual parts of the body after contralateral cortical tissue has supposedly been removed.

JOHN MARTIN, M.D.

Oldberg, S.: The Significance of Internal Frontal Hyperostosis and Some Related Changes of the Skeleton, with Special Reference to Diabetes in the Aged (Ueber die Bedeutung der Hyperostosis frontalis interna and einiger verwandter Skelettveraenderungen unter besonderer Berueecksightigung der Verhaeltnisse bei Altersdiabetes). *Upsala läk. fören. förh.*, 1945, 51: 1.

During the last decades the cranial change, which for a long time has been called "hyperostosis frontalis interna," has aroused an increasing interest from the clinical as well as from the pathologico-anatomical point of view. Under the more comprehensive names "hypophyseal cranial dysplasia" or "metabolic craniopathy" a more diffuse thickening of the calvaria is found. While the afore mentioned endocrine origin of local frontal hyperostosis has been generally accepted, the genesis of diffuse hyperostosis is less clear, and an association between both forms has not been proved. Certain bony changes, which have been assigned to the normal increase in age, the so-called senile hyperostosis, have been of great importance in the subject under discussion. The occurrence of the last mentioned change has been considered self-evident for at least 100 years but systematic investigation has not been made.

The clinical significance of the cranial changes is not clear. They have been included together with

adiposity and certain psychoneurological symptoms in the so-called Stewart-Morel syndrome and with adiposity and virilism in the Morgagni syndrome. Some authors have emphasized that in case of local frontal hyperostosis a disorder in the carbohydrate metabolism in the diabetic sense may occur. The suggestion has been advanced that by confirming this bone formation an opportunity is afforded for diagnosing pituitary diabetes. The circumstances, however, are not cleared up and no research has been made on a larger scale.

From his x-ray studies, the author has tried to find out the appearance of the normal calvaria at different ages. The occurrence of the local frontal hyperostosis as well as the general thickness was observed, being directly measured on the x-ray plate at certain points. The results thus obtained were taken as a starting point and the same investigation was carried out on material consisting of selected cases of local frontal hyperostosis, acromegaly, hypophyseal adenoma operatively verified, and also a number of cases of senile diabetes. The author tried to clarify the so-called senile hyperostosis, and the hypophyseal genesis of the diffuse thickening of the skull, and, by measuring the sagittal diameter of the atlas, tried to get a clear idea of the relationship of localized changes of the skull to more general disturbances in growth. By means of a comparison between cases with and without frontal hyperostosis and the diffuse thickening of the calvaria, respectively, the author tried to find evidence for the clinical significance of these bone changes. Special interest was taken in the possibility of classifying the cases of so-called senile diabetes in two genetically different forms.

The result of the investigation can be summarized as follows:

1. Signs for the so-called senile hyperostosis are lacking.

2. Hyperostosis frontalis interna appears almost exclusively in female patients, usually first after the menopause, and increases in frequency with age. The endocrine disorder in these patients manifests itself furthermore in a delayed menopause.

3. The general thickness of the calvaria can be attributed directly to a disturbance in growth of hypophyseal origin. It is most pronounced with acromegaly and a little less pronounced with chromophilic hypophyseal adenoma without acromegalic signs, whereas in the case of chromophobic adenoma the thickness is about normal, but still shows some difference.

4. Hyperostosis frontalis interna is positively correlated with a diffuse thickening of the os parietale and consequently with the diffuse thickening of the calvaria. Accordingly it often occurs in cases of acromegaly.

5. In cases of acromegaly as well as of local frontal hyperostosis there is, furthermore, an enlargement of the sagittal diameter of the atlas. Thus, there exists an association among hyperostosis frontalis interna, the diffuse thickening of the calvaria, and the enlargement of the atlas, which must be considered as a general growth tendency in the skeleton. The hypophyseal genesis of this bone change is discussed.

6. Hyperostosis frontalis interna and, to a certain extent, the general thickening of the calvaria are in a co-ordinative relation with adiposity, dizziness, and probably with headaches. Therefore, the term "Stewart-Morel syndrome" seems to be justified. On the contrary, there is no relationship between the afore named bone change and hypertrichosis, therefore the term "Morgagni syndrome" seems to be inadequate. The occurrence of dizziness and headaches does not correspond to an increase in the blood pressure. In the diagnosis of adiposity in its different forms the aforenamed bone changes seem to point to a hypophyseal origin.

7. The occurrence of local frontal hyperostosis and to a certain degree even that of the diffuse thickening of the calvaria, in women as well as in men, suggests the possibility of an extrainsular diabetes of hypophyseal origin when the diabetes presents: (a) a benign course, not infrequently with spontaneous remission; (b) a slight acidotic tendency, and thus an inconsiderable risk of coma; (c) a requirement of insulin only in a few cases, exclusively those of persons who have been ill for several years; and (d) a decrease in sensitivity to insulin.

8. The occurrence of hyperfunction of the anterior lobe of the pituitary gland, especially in women after the menopause (formerly chiefly recognized by an increased excretion of gonadotropic hormone), includes even a growth promotive factor and probably also a diabetic one. The practical value of the afore mentioned changes of the skeleton as an easily diagnosed clinical sign for hyperpituitarism is emphasized.

Davison, C., and Demuth, E. L.: Disturbances in Sleep Mechanism; A Clinicopathologic Study. Lesions at the Corticodiencephalic Level. *Arch. Neur. Psychiat.*, Chic., 1945, 54: 241.

Discrete lesions of the hypothalamus are known to cause interference with the normal physiological regulation of sleep, and all the available clinical evidence indicates that lesions at the corticodiencephalic level not uncommonly produce pathological sleep as well. The authors have had 25 patients with such pathological sleep syndromes. In all, either the cortex or the diencephalon, or both, were involved. Twenty-one patients suffered neoplastic disease, and the 4 other patients had brain abscess, encephalitis lethargica, diffuse syphilitic disease, and vascular disease. A strikingly high percentage of the patients showed clearly an extensive change in the hypothalamus. This structure showed compression changes in 16 cases, actual invasion in 4 cases, and gross destruction in 1 case. In 2 patients, however, the hypothalamus, though compressed, did not show any change in the nerve cells. Also, in 16 patients there was, in addition to the changes in the hypothalamus, compression or invasion of the basal ganglia with implication of the striohypothalamic pathways. Inas-

much as most of the neoplasms in the series were found to have encroached upon the ventricular system, a high incidence (18 patients) of increased intracranial pressure was present in this series.

In a previous article the authors expressed the opinion that some fibers for the control of sleep were believed to originate in the cerebral cortex, especially the hypocampal, angular, frontal, premotor, and temporal convolutions. On the basis of the 25 case histories reviewed in the present article, they postulate that the following structures (both afferent and efferent in nature) are concerned with sleep regulation: the medial forebrain bundle running between the ventromedial olfactory correlation areas of the cortex and the preoptic and hypothalamic areas; the corticohyothalamic fibers, via the fornix; the inferior thalamic peduncle; and a postulated "hypothalamocortical" tract. JOHN MARTIN M.D.

Bucy, P. C.: Surgical Relief of Tremor at Rest. *Ann. Surg.*, 1945, 122: 933.

A case report is made of a 23 year old male with a diagnosis of unilateral Parkinson's syndrome on the right side following chronic encephalitis, the onset of which apparently took place at the age of 5½ years. The patient showed marked unilateral tremor, a weakness of the right lower extremity of slight degree, and possibly some weakness of the right upper extremity.

Operation was performed; the central sector of the cortex of the left cerebral hemisphere was exposed up to the midline, with the fissure of Rolando in the middle of the operative field. The cortex did not appear abnormal. All of the exposed cortex was electrically stimulated, following which the posterior half of the precentral gyrus was removed over the area which had caused movement (by stimulation) in the right upper and lower extremities. The area was resected subpially down to the bottom of the central sulcus. The great rolandic vein and the communicating vein which crossed the region of extirpation were left intact.

Following operation, the patient had complete paralysis of the right upper extremity, and marked weakness of the right lower extremity. There was gradual improvement in function of the right side, without evidence of a return of the tremor.

The last report (9 months after operation) stated that the patient was able to walk with his body upright, rather than with a hemiparetic gait. The tendon reflexes were increased on the right side, although this had been true preoperatively. There was no evidence of return of the tremor up to that time.

The area extirpated was "the arm and leg" portion of area 4 Y., and according to the author, such extirpation can be expected to abolish tremor at rest in the contralateral upper and lower extremities. The procedure may be expected to produce some increased spasticity and increased perspiration over the right half of the body for a few days. No sensory alterations were noted. HOWARD A. BROWN, M.D.

Bailey, P.: Chronic Leptomeningeal Thickening following Treatment of Meningitis with Sulfa Drugs. *Ann. Surg.*, 1945, 122: 917.

Four cases of meningitis are reported which were treated with sulfa drugs or penicillin. These cases demonstrated the sequelae which may occur despite the use of these drugs. In all 4 cases the acute purulent infection was controlled, but despite this the condition went on to death or a serious sequel because of the fact that the drugs exert no restraining influence on the fibroblasts which proliferate rapidly in an attempt to organize the exudate.

As a result of these changes, the leptomeninges become densely scarred, and prevent the normal circulation of cerebrospinal fluid. There also may be constriction of the blood vessels as a result of the same pathological process.

The author intends to call attention to the dangers that may arise as a result of these alterations in the nervous system, although early optimism may arise immediately following the administration of these drugs in the treatment of purulent meningitis.

It is not his contention that the drugs should not be used, but he states that early diagnosis and intensive therapy with adequate doses before massive exudate has occurred may be of value in preventing these changes, and improving the prognosis.

HOWARD A. BROWN, M.D.

SURGERY OF THE THORAX

CHEST WALL AND BREAST

Spalding, J. E.: Adenolipoma and Lipoma of the Breast. *Guy's Hosp. Rep., Lond.*, 1945, 94: 80.

The author reports the case of a 56 year old woman who had noted a swelling of the left breast for one year. Since she first noticed the swelling the breast had steadily enlarged. Examination of the breast revealed a lump 8 cm. in diameter immediately lateral to the areola. The mass was spherical, well defined, and freely movable within the breast. The axillary lymph nodes were not enlarged. The breast was amputated.

The tumor mass was well defined. Microscopically the tumor consisted of fat tissue with islands of epithelium embedded in the fat. In the central part of the tumor there were large islands of epithelial tissue in which alveoli, alveolar ducts, and larger ducts could be distinguished.

The author considers this to be not a pure lipoma but rather an adenolipoma. He described 2 lipomas of the breast that are in the Gordon Museum.

EARL O. LATIMER, M.D.

TRACHEA, LUNGS, AND PLEURA

Clark, D., and Gilmore, J. H.: A Study of 100 Cases with a Positive Coccidioidin Skin Test. *Ann. Int. M.*, 1946, 24: 40.

One or more coccidioidin intracutaneous tests were made on 372 patients, and from 125 with a positive reaction, 100 with residual roentgenographic findings in the lungs were chosen for study, analysis, and report. This investigation was made in the pulmonary section of an Army General Hospital serving the southwestern part of the United States in 1942.

The fungus coccidioides immitis is found in arid soil, and has been isolated from wild rodents in central and southern California, Arizona, New Mexico, and West Texas. The organism is diphasic, occurring in animal tissue as a spherule from 1-60 micra in diameter, with a doubly refractile wall, and multiplying by endosporulation.

The earliest pathological lesion in man, as surmised from studies on animals, is an infectious granuloma following the inhalation of infected dust, or, more rarely, entrance through a lesion in the skin. The infection is usually mild, self limited, and involves the lungs and associated mediastinal lymph nodes. Antibodies develop in the blood and the lesion disappears, or fibrosis leaves a rounded or linear scar, and solid immunity. Reinfection does not occur. Exceptionally, an abscess may form in the lung or pleura and heal by absorption and fibrosis, or it may break down and discharge organisms through a bronchus, which appear in the sputum for months or years without causing secondary lesions. Rarely, chiefly in individuals of the dark skinned races, the infection gains entrance to the blood stream and causes death. In survivors, granulomas appear throughout the body. These tumors may be slowly absorbed or may form chronic abscesses.

The differential diagnosis included tuberculosis, residual pneumonitis, fibrosis, healed septic abscess, bronchitis, bronchiectasis, Boeck's sarcoid, and metastatic malignancy. Attention was paid to residence in areas endemic for coccidioides, skin tests for coccidioidin and tuberculin, the sedimentation rate, sputum, study of the blood for coccidioidal antibodies, and roentgenographic examination of the chest.

Fifty-two patients had fever, mild chills, cough, occasional slight hemoptysis, small amounts of mucoid sputum, chest pain, and malaise. Four had skin manifestations. Evaluation of the lungs could not be made without roentgenograms, although pleurisy, pleurisy with effusion, and pneumonitis secondary to coccidioidal infection were sometimes found on physical examination.

Coccidioidomycosis mimics tuberculosis; however, superinfection or the adult type of pulmonary tuberculosis is not characterized by hilar or mediastinal adenopathy. Roentgenographic findings may be grouped under five major types: (1) with pneumonialike infiltrations; (2) with tracheobronchial mediastinal or hilar adenopathy, or a combination of both; (3) discrete nodular type with a round or oval area of increased density from 2 or 3 to 10 mm. in diameter, occasionally calcified; (4) with annular shadows having thick walls; and (5) with upper lobe granular, or with slightly nodular infiltrations with extension of linear markings into the hilum. As healing takes place initial pneumonialike infiltration is followed in some cases by complete disappearance of the lesion, in others by nodular lesions, by annular lesions, or by strandlike infiltrations.

Many individuals who have been in southwestern United States show a positive reaction to the coccidioidin skin test, and some of these show roentgenographically persistent areas of increased density in the lungs which can be disregarded as a cause of future illness or disability if they are due to an inactive coccidioidal infection, but they must be distinguished from tuberculosis and, more rarely, other potentially dangerous diseases.

A lung lesion absent in previous chest films, but present some time after an individual was on the desert is probably due to coccidioidomycosis. Coccidioidin in concentrated form for skin testing in a 1:100 dilution with normal saline solution was obtained from Charles C. Smith of the Department of Public Health, Stanford University.

LYNN JOHNSEN, M.D.

Camauer, A.: Cancer of the Lung with Initial Neurological Symptoms (Cánceres de pulmón con síntomatologia inicial neurológica). *Rev. As. méd. argent.*, 1945, 59: 1088.

Following a brief discussion of the many syndromes due to pressure on the peripheral and central nervous systems by the growth of the metastases of pulmonary tumors, the author notes that in the material at the Hospital Rawson in Buenos Aires the most common form of pulmonary tumor is silent and announces itself as a hemiplegia with a progressive, subacute course. with localization of the metastases at the level of the internal capsule, in the subcortical area, or in the ascending frontal or motor convolution. This metastatic growth then tends to invade the cortex in this area, producing the Bravais-Jacksonian type of epilepsy, and later the other structures of the brain, particularly the basal nuclei and ventricles, and leads to an early death. There is a relatively late appearance of evidence of intracranial pressure, the demise being due rather to the interruption of the vital nerve impulses from the central nuclei.

The article concludes with 4 typical case histories, all in males from 34 to 66 years of age. In each case the hemiplegia was on the left side, progressing rapidly to complete paralysis of the left arm and leg, and in no case was any evidence of lung involvement observed until the x-rays were used. By this means an original new growth was discovered at the hilus of the right lung in 1 patient, at the right vertex and base, respectively, in 2 patients, and at the vertex of the left lung in the last patient.

JOHN W. BRENNAN, M.D.

Strieder, J. W., and Lynch, J. P.: Putrid Empyema. *N. England J. M.*, 1946, 234: 1.

A better understanding of putrid empyema, to be distinguished by surgeons from pyogenic empyema, will bring prompt recognition, adequate treatment, and lowered mortality. An analysis of 90 cases at the Boston City Hospital, Boston, Massachusetts from June, 1934 to January, 1941, and of specific cases subjected to thoracic surgery between January, 1938 and January, 1941, demonstrates the advantages of early radical surgery.

Putrid empyema, a sloughing gangrenous pleuritis, is caused by anaerobic bacteria in symbiosis, and characterized by purulent, foul, sulfurous, or putrid pleural fluid and often gas. From 5 to 10 per cent of 530 cases of empyema treated at the Boston City Hospital in 7½ years were putrid.

Putrid empyema complicated lung abscess, gangrenous fusospirochetal pneumonitis, bronchiectasis, tuberculosis with secondarily infected blocked cavities which ruptured into the pleura, pulmonary gangrene distal to obstructing carcinoma, and trauma. The acute stage of all putrid pulmonary infections is believed to be pneumonitis as distinguished from pneumococcal pneumonia.

The clinical impression on admission was pneumonia; the physical signs were those of fluid; roentgenograms showed consolidation even when fluid was present. A history of foul sputum was diagnostically helpful. The patients early became toxic and delirious, and showed signs of peripheral vascular collapse, and the pulse was elevated out of all proportion to the temperature, a feature common to all anaerobic infections.

Thoracentesis fluid with a foul odor was pathognomonic. Direct smear revealed fusospirochetes. Anaerobic culture of the pleural fluid demonstrated infection in which symbiosis was involved and related to the antecedent disease. Vincent's angina, peridental infection, and pyorrhea alveolaris were common in the patients from whom the organisms were aspirated. The infections are referred to as fusospirochetal, but anaerobic cocci are associated with them and are of equal importance.

Common to all anaerobes is their inability to live or multiply in an atmosphere rich in oxygen. Consequently, open operation with adequate aeration and evacuation of the pus is the treatment of choice. Despite the consistency of the fluid, there is prompt stabilization of the mediastinum.

If this is inadequate the pleura is widely incised, for about 20 cm. A large prepared dressing is applied, and the patient is quickly turned on his back. The dressing becomes saturated and serves as a tampon preventing air exchange, while the large wound allows complete drainage. A quick change of dressing is made during expiration the third day. Stabilization occurs from the fifth to the seventh day. A gauze pack impregnated with activated zinc peroxide placed partly in the pleural cavity and partly in the wound controls odor, and the wound is clean and granulating in from 5 to 7 days, when the tubes are inserted for convalescent care.

Sulfonamides and arsenicals are of no benefit, but penicillin is a valuable adjunct and effects cures in a certain percentage of cases. Recovery is greatest with early operation. Seventy-five per cent of the patients operated upon in the first week recovered. Only 1 patient lived when the disease had persisted 10 days before operation. The surgical treatment generally given for postpneumonic empyema was not adquate for putrid empyema. The mortality under such conditions was 54 per cent. Three deaths among the 21 patients recovering from open resection indicate that a fatal outcome in spite of adequate surgical treatment is usually due to the primary disease. The results obtained demonstrate the benefit of immediate surgery of the open type. The use of activated zinc peroxide packs is specifically helpful.

LYNN JOHNSEN, M.D.

HEART AND PERICARDIUM

Bianchi, A. E., and Rapaport, M.: Sarcoma of the Right Auricle (Sarcoma de la auricula derecha). *Arch. Soc. argent. anat. normal.*, B. Air., 1945, 6: 321.

The author describes a primary sarcoma of the right auricle of fusocellular type which formed numerous metastases in the lungs and showed a rapid evolution.

He also collected 34 cases of sarcoma of the right auricle from the literature. Histologically the growths were formed by giant, round, or polymorphic cells; a few of the growths were fibrosarcomas and fusocellular sarcomas. One was a fibroblastic sarcoma, and one a leiomyosarcoma.

In regard to the mode of growth, four types of auricular blastomas may be differentiated: (1) those of an infiltrating character, only partially obstructing the auricular cavity, (2) those growing exuberantly, filling the cardiac cavity and transforming it, as in the authors' patient, into a narrow canal, (3) those affecting chiefly the superior vena cava, and (4) those infiltrating chiefly the myocardium.

Among 35 cases collected from the literature by the authors, metastases were found in the lungs in 12 cases, in the heart in 10 cases, in the mediastinal glands in 7 cases, in the liver in 3 cases, and in the pericardium in 3 cases, while the suprarenal glands, brains, inferior vena cava, pancreas, and pleura were less frequently the sites of secondary growths. In numerous instances multiple metastases were present, but no metastasis was found in 12 patients.

The authors' patient was a woman 30 years of age who developed dyspnea and an enlargement of the heart 6 months prior to her admission to the hospital. Auscultation failed to reveal any valvular lesions. Gradually an edema of the left upper extremity and of the left side of the chest developed and a considerable enlargement of the liver was noticed. Hemoptysis and edema of the lumbar region and of the lower extremity gradually appeared. No tubercle bacilli were found in the pleural exudate. The fever was of a recurrent type.

The autopsy revealed a sarcoma of the right auricle with metastases in the pleura and the lungs, fibroplastic pericarditis, and dilatation of the heart.

JOSEPH K. NARAT, M.D.

MISCELLANEOUS

Ratzan, M. C., and Thompson, S. A.: Hypoproteinemia in Surgery of the Thorax. *Am. J Surg.*, 1945, 70: 213.

Hypoproteinemia in patients with intrathoracic disease is insidious in onset and course, progressive in character, and dangerous. Clinically, a total protein value of below 5 gm. per cent will find healing markedly impeded. As the percentage is lowered, gaping of fascial planes, herniation, and evisceration occur. The cardiorenal dysfunction attendant upon a total protein value of below 5 gm. per cent, and an albumin value of below 3.2 gm. per cent will yield a final anasarca.

The balance of protein is obtained through the interplay of 4 factors: (1) the exogenous source (food); (2) the synthesis of albumin, globulin, and fibrinogen by the liver, after protein breakdown and amino acid splitting; (3) loss of protein through increased metabolism and continued inflammation (effusion and empyema); and (4) the excretion, mainly urinary albumin. In thoracic surgery, all of these factors are abnormal.

The lowering of the plasma protein in cases requiring thoracic surgery is largely dependent upon the intrapleural condition. It is also moderated by the extent, type, and severity of the operative procedure.

The use of blood transfusions, plasma, and amino acids by mouth or parenterally must be employed to augment protein intake when excessive postoperative protein depletion is anticipated. The most economical protein replenishment is obtained by the intravenous or intramedullary use of amino acids; either the acid hydrolysate with tryptophan or the enzymic digest are suitable for this purpose.

SAMUEL KAHN, M.D.

SURGERY OF THE ABDOMEN

GASTROINTESTINAL TRACT

Fernandes, O.: Roentgenological and Clinical Study of Duodenal Stasis (Estudo radiológico e clínico das estases duodenais). *Brasil med. cirurg.*, 1945, 7: 355.

After presenting a short review of the embryological development of the duodenum, the author offers the following classification of duodenal obstruction:

A. Intrinsic lesions: (1) congenital: partial or total absence of fixation with abnormal mobility and diverticulum; (2) acquired: diverticula, bridges, adhesions, modification of the mucosa, hypertrophy of the muscular layers, ulcers, tumors, and foreign bodies.

B. Extrinsic lesions: compression by tumor, and compression by a pedicle of the mesentery.

C. Functional lesions: spastic conditions, hypotonia, and atony.

A mobile first portion of the duodenum may form a festoon and cause obstruction. In other cases only the portion just above or immediately below Vater's papilla is abnormally mobile; and in another variety of mobile duodenum only the third portion is involved. A total mobile duodenum is a rare malformation making up a part of the anomaly called "common mesentery."

A diverticulum may be located at the duodenojejunal junction or higher up. Diverticulitis may be the sequel of duodenitis. An acquired diverticulum may form above a stenosis, and results from a lack of equilibrium between the duodenal contents and the resistance of the wall.

Bridges, bands, and adhesions usually are the result of chronic adhesive peritonitis. Hereditary syphilis, tuberculosis, cholelithiasis, and other conditions may produce an inflammatory periduodenitis. Similar processes may follow more distant infectious conditions located in the pelvis or around the appendix.

Intensive duodenitis may spread to the submucosa and cause a hypotonus accompanied by a diminished peristalsis which leads to stasis. Hypertrophy of the valvulae conniventes may also cause stasis. Hypertrophy of the muscular layer may lead to the formation of a veritable sphincter.

Ulcers may be caused by or provoke the occurrence of stasis, because of adhesions and cicatricial stenosis. Irritation of the mucosa by violent peristaltic and antiperistaltic motions and trauma of the epithelium in the presence of stasis may cause the formation of an ulcer. Among benign tumors causing stasis the following may be mentioned: adenoma, fibroma, lipoma, myoma, and hemangioma. Such tumors may be sessile or pedunculated. Malignant tumors such as carcinoma, fusocellular sarcoma, myxosarcoma, and melanosarcoma are rare in this condition.

As to foreign bodies, gallstones are the most frequent.

A ptosis of the anterior branch of the vascular mesenteric pedicle may cause a pinching of the third portion of the duodenum. Two arteries may compress the anterior aspect of the duodenum, namely, the superior mesenteric and the middle colic arteries.

A chronic duodenal stasis is characterized by the following signs: a rise of nonprotein nitrogen in the blood, an increase of the alkaline reserve, a considerable fall of the blood chlorides, an intensified nitrogen excretion in the urine, a dimunition of chlorides in the urine, and hyperpolypeptidemia.

JOSEPH K. NARAT, M.D.

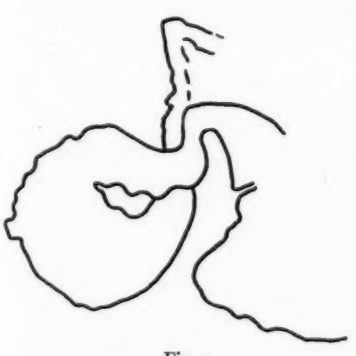


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 1. Defective fixation of the supramesocolic segment. Stenosis of the duodenojejunal angle. Fig. 2. Total mobile duodenum. Fig. 3. Submesocolic stenosing periduodenitis.

Golden, R., and Ducharme, P.: The Clinical Significance of Deformity of the Cecum in Amebiasis. *Radiology*, 1945, 45: 565.

Because several cases were encountered at Presbyterian Hospital, New York City, in which the first suggestion that amebiasis was present came from the demonstration of a deformed cecum, the authors undertook a review of the records of the 119 cases observed at this hospital in which amebiasis was either proved or thought to be present. In 108 of these cases the endamoeba histolytica was recovered either from stools or tissues; in several of the remaining cases only one stool had been examined.

The cases were grouped into (a) 61 with diarrhea, (b) 15 with abdominal pain without diarrhea, (c) 34 with no significant symptoms directly referable to the intestinal tract, and (d) 9 in which there was inadequate information in regard to abdominal pain. Barium examination was done in 33 of the cases with diarrhea, of which 18 showed a deformed cecum; among the 9 cases with abdominal pain a cecal deformity was demonstrated in 3; among the 18 in group *c* a cecal deformity was found in 4, and among the 7 cases in group *d* a deformed cecum was discovered in 5. Hence, of the 67 cases subjected to colonic barium study, 30 (45%) showed a cecal deformity, and this finding occurred 5 times as frequently in cases with diarrhea or abdominal pain as in cases without such symptoms. In 58 of this group of 67, the endamoeba histolytica was demonstrated in the stools, and its presence was not disproved in the other 9. Of these 58 cases, 21 (36%) showed cecal deformity, while another case with deformed cecum and ascending colon terminated in clinical recovery only after a course of emetine. Two other cases of proved amebiasis showed deformity of the transverse colon, and a third revealed rectal stricture. Hence, approximately 50 per cent of the patients examined and 41 per cent of those with endamoeba histolytica in their stools had definitely abnormal roentgen findings; 90 per cent of these deformities were of the cecum. In only 2 cases showing a deformed cecum was there also an associated deformity of the more distal colon, but in none of the cases was the terminal ileum narrowed or intrinsically distorted.

In the majority of cases of deformed cecum, the cecal outline was smooth, and in a few, irregular. The deformity, to be significant, should be persistent in some degree throughout the examination. In 4 of the 5 cases re-examined after therapy for amebiasis, some decrease of the deformity was noted, but in the fifth case, in which shrinkage was extreme, no change resulted. The authors believe that at least a portion of the reversible change is due to cecal spasm.

As regards the differential diagnosis, the authors point out: (1) that in the large majority of cases tuberculosis involves both the cecum and ileum, although hyperplastic tuberculosis of the cecum could simulate the deformity described above; (2) that regional ileitis commonly involves the ileum, often with resultant narrowing and irregularity of the terminal portion, but it attacks the cecum much less commonly; (3) that carcinoma of the cecum usually produces an irregular asymmetrical filling defect often associated with a palpable mass, quite different from the usually smooth walled contracted cecum of amebiasis, but, of course, should a mass be formed by a large amebic granuloma, it could not be distinguished roentgenologically from carcinoma.

The authors conclude that recognizable deformity of the cecum without involvement of the terminal ileum is likely to be present in more than a third of the cases of amebiasis, and that this deformity is a clinically valuable sign, not diagnostic, but definitely suggestive of the disease. Its absence, on the other hand, is of no value in ruling out the disease.

LILIAN DONALDSON, M.D.

Clute, H. M., and Kenney, F. R.: Primary Anastomosis in Carcinoma of the Colon. *N. England J. M.*, 1945, 233: 799.

Sixty-five cases of carcinoma of the colon are reviewed. The total mortality was 12 per cent (8 deaths); in 34 cases with resection and immediate anastomosis there was a single death, or a mortality of 3 per cent. Eighteen cases requiring Mikulicz resection had a 4 per cent mortality (2 deaths). Seventeen inoperable cases upon which only paliative procedures could be done had a mortality of 29 per cent (5 deaths). Of the deaths among the resectable cases, 1 was due to shock, 1 to coronary thrombosis, and 1 to pulmonary embolism.

These cases evaluate the feasibility of immediate restoration of the intestinal continuity following radical resection of carcinoma of the colon. The authors intended to evaluate the use of chemotherapy in the improvement of their results but became impressed by the numerous factors that had improved colon surgery. They emphasize the value of preoperative and postoperative care. The treatment of anemia and protein deficiencies is accomplished with adequate quantities of blood and the intravenous administration of amino acids before and after surgery. The authors value the use of sulfasuxidine in the preoperative reduction of intestinal flora and because of its mild laxative effect, but note that cases in which it was not used presented equally good results in many instances. They have discontinued the preoperative use of drastic purgatives. Gastric suction is advised for a day before operation and is continued postoperatively until the return of normal peristalsis.

The authors favor radical removal of the tumor and of the lymph glands draining the involved segment of colon. The Mikulicz and other obstructive resections have been relegated to cases in which the risk is poor, with partial obstruction or some degree of infection, because they can be done quickly and the bowel is simultaneously decompressed. Resection and immediate anastomosis are preferred because of the many advantages to the patient, such as the elimination of spur crushing and of the an-

noyances associated with a colostomy. Primary anastomosis has not increased the mortality. The authors did not use many cecostomies but believe that cecostomy is a worthwhile procedure to protect the anastomoses distal to it in the colon and to decompress the obstructed colon, which eliminates the necessity of resection for the obstruction.

The article presents the advances made in colonic resection in the last few years, particularly since the introduction of drugs reducing the incidence of infection, and the greater knowledge of fluid balance and of total nutrition of the surgical patient.

FREDERICK C. HOEBEL, M.D.

LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

With, T. K.: On the Occurrence in Human Serum of Yellow Substances Different from Bilirubin and Carotenoids. *Acta med. scand.*, 1945, 122: 501.

The author has described a method for the quantitative estimation of the nonbilirubin yellow substance in serum by means of the Pulfrich photometer. Investigation of the spectral absorption of pure solutions of bilirubin and solutions of bilirubin in serum were carried out, and it was shown that the proportion between the extinction of the diazo reaction with filter S.61 and that of the spectral absorption of bilirubin with S.43 in the Pulfrich photometer (E.61/E.43) for solutions in serum had a constant value with only little variation from one serum to the other.

The determination of the proportion E.61/E.43 of different sera showed values considerably below the characteristic value for pure bilirubin serum solution for most of them. Consequently, the regular occurrence in human serum of yellow substances different from bilirubin is to be looked upon (by the author) as an established fact. It was also demonstrated that the concentration of these yellow substances in serum was of the same magnitude as the bilirubin concentration. It exceeded the concentration of the serum carotenoids considerably. Further, it could be demonstrated that hemoglobin or biliverdin could not be the cause of these findings.

The chemical nature of the nonbilirubin yellow substance and its physiological properties are discussed and the hypothesis is advanced that in human serum it is identical with the xanthorubin of hepatectomized dogs and with the pyrrol compounds, bilifuscin or mesobilifuscin. DAVID H. LYNN, M.D.

Clagett, O. T., and Hawkins, W. J.: Cystic Disease of the Liver. *Ann. Surg.*, 1946, 123: 111.

Simple solitary cysts of the liver are localized and usually circumscribed, and occasionally they possess a pedicle. The result is that surgical treatment is far more often possible for solitary cysts than for cystic disease, wherein the lesion is more generalized with reference to the liver.

The authors' patient was a married man, 39 years of age. His chief complaints were a feeling of fullness and dull aching in the epigastrium. This distress had been present for 4 years. The symptoms progressed until, at the time of his examination at the clinic, he was aware of a large mass in the epigastrium and was unable to ingest even a moderate amount of food without feeling discomfort. In spite of the normal results obtained in investigating the pancreatic function, it was thought that the epigastric tumor was probably a pancreatic cyst.

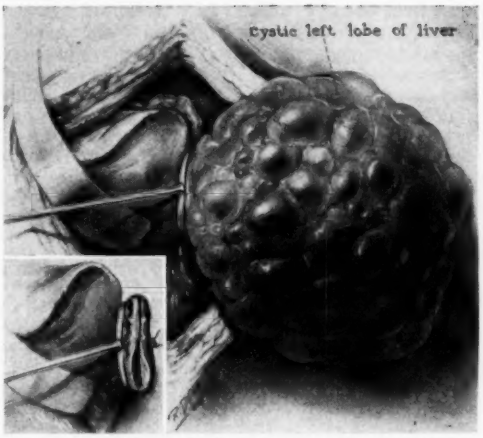


Fig. 1. Left lobe of the liver involved by cystic disease; tourniquet applied around its pedicle. Inset: Removal of left lobe of liver and closure of pedicle with interrupted mattress sutures. (Courtesy of J. B. Lippincott Co.)

Accordingly, on August 12, 1944, operation was performed through a primary upper left rectus incision. Immediately, a portion of the mass, consisting of multiple various sized cysts, presented itself into the incision. On further examination it was found that this represented the left lobe of the liver. Examination of the right lobe showed it to be normal in appearance. Palpation of both kidneys was then done and neither seemed to be cystic. By separating numerous adhesions from the mass, a relatively narrow pedicle was encountered adjacent to the ligamentum teres. A Bethune pneumonectomy tourniquet was then applied around the pedicle (Fig. 1) and the entire left lobe of the liver was removed en masse. The remaining stump was closed with interrupted chromic catgut sutures. The tourniquet was then removed and there remained only minor oozing of blood from the stump.

Five grams of sulfanilamide powder were sprinkled into the area and one double iodoform pack was placed to control what oozing might occur from the stump. Two Penrose drains were brought out through the incision. The specimen included the entire left lobe of the liver, consisting of multiple cysts lined by epithelium of the bile duct type. The postoperative convalescence was uneventful.

As far as the authors were able to determine from the literature, this case is the first one reported in

which the entire left lobe of the liver was removed for cystic disease. The only other reported case of a similar nature was that of von Haberer, who in 1908 removed the entire left lobe of the liver, because of a nonparasitic solitary cyst which occupied the greater part of that lobe.

Most authors agree that the cause of the simple solitary cyst is some form of local obstruction in the biliary tract with a resultant retention type of cyst. In cystic disease, however, opinion seems to be divided, since there are various hypotheses as to its pathogenesis.

All of the articles reviewed make special mention of the fact that cystic disease of the liver is usually associated with cystic disease elsewhere—notably in the kidney. When there are associated renal lesions, they are usually far more advanced than the lesions in the liver.

If a cystic liver has enlarged to the point of causing a palpable mass, the identity of which cannot be proved, then exploration of the abdomen is advisable. When such a lesion is encountered, two alternatives are possible: (1) the involved portion can be removed, or (2) nothing should be done. The decision to excise the lesion must be made only after several factors have been considered. The kidneys should be palpated. If they, too, are involved seriously, then there is no point in attempting to excise a portion of the liver; the hazards of this procedure are well recognized.

If the patient has been asymptomatic in spite of the presence of the cystic liver and if removal of the tumor would involve too great a risk, then one would be justified in doing nothing. If, on the other hand, the tumor is interfering with the patient's well-being, the kidneys are without palpable involvement, and removal of the lesion would not be too hazardous a procedure, then extirpation certainly is justifiable.

Mirizzi, P. L.: The Diagnosis of Choledocholithiasis (Diagnóstico de la colédocolitiasis). *Prensa méd. argent.*, 1945, 32: 2039.

The value of the usual preoperative clinical and laboratory procedures for the detection of stone in the common duct and/or the adjacent hepatic bile passages is admitted, but the author deprecates the fact that they should play more than a modest role in the integral diagnosis of choledocholithiasis. Attempts at preoperative filling of the common bile duct with shadow producing medium by reflux from the duodenum (duodenal catheterization) is mentioned without enthusiasm and as being only rarely successful. Even the nonsurgical cholangiography of Lee of Philadelphia, whereby the gall bladder is injected with a shadow medium through a peritoneoscope, is regarded askance as being essentially a surgical procedure, as being applicable to not more than 50 per cent of the gall bladders, and as being of uncertain innocuity because it leads to biliary peritonitis and other accidents. In fact, all of these procedures pale in significance in face of the inescapable duty of the surgeon, not only to arrive at the diagnosis of choledocholithiasis, but also to be certain that the patient has been freed of all the stones in the bile duct. Even laparotomy with direct palpation of the choledochus, choledochotomy with instrumental probing of the bile passages, and perhaps the choledochoscopy of McIver are not without objections, and although of aid in determining the presence of canalicular lithiasis in a large proportion of cases, they do not afford an absolute diagnosis.

Operative cholangiography, on the other hand, has contributed extensively in confirming the diagnosis of stone in the bile tracts; it is a valuable source of information in lithiasis of the ampulla of Vater and intrahepatic stone; it furnishes capital data on the psuedotumoral form of choledocholithiasis, and represents an irreplaceable recourse for providing assurance that all of the concretions have been removed from the principal bile duct. In the case of the calculus located at the ampulla of Vater, even when it is too small to show on the film as the usual punch press defect at the lower end of the common bile duct (where the usual outline of the ampulla would be expected) or as the less common defects, such as the right angled, unciform, parrot beaked, festooned and angulated defect appearance, its presence will at times be suspected by the reflux into the duct of Wirsung—which is more persistent than in the cases of simple dystonia of the sphincter of Oddi.

This question of persistence, however, also brings up the matter of the functional criterion in the roentgenological examination of these patients, that is, the taking of one or more cholangiographic exposures following the original one. For instance, in 1 patient of the author's material, the first film disclosed a typical inflammation of the sphincter of Oddi with the usual "Havana cigar" tip to the ampulla; another film was taken and this proffered the classical image of calculus of the papilla (punch press defect) with injection of the duct of Wirsung; in another, the first exposure depicted a punch press defect, while the subsequent film showed the condition to be normal. Of course, the taking of two, or of several films at varying intervals is not of itself sufficient to solve all the problems in stone in the bile ducts; frequently all attainable facts will have to be marshalled to arrive at a correct diagnosis.

In 1 patient a history of persistent icterus caused the author to explore the nonfilling left hepatic duct where, in spite of the fact that hepatic duct stones are nearly always multiple, and primary stone in the hepatic duct without accompanying involvement of the common duct is a great curiosity, a single large stone, the shape of a Winchester bullet with nose pointing downward, was extracted from the hepatic duct. After this the hepatic system filled normally with shadow medium. At operation in this case the choledochus was found to fill and empty into the duodenum in an unobstructed manner.

However, stone is not the only condition preventing the filling of part of the bile tract during the

operative cholangiographic examination. It may be necessary, in addition to injecting the shadow mixture through the gall bladder or the stump of the cystic duct, to open the choledochus itself and make an injection through the choledochotomy opening. Or it may even be necessary to provide the injecting syringe with a filiform catheter and push this into the different sections of the bile tract system. This is likely to be necessary in the dilated and distorted passages of the longstanding, recurring case of gallstones.

Even if all methods have been exhausted without an explanation of a longstanding clinical history of mechanical icterus, one is still justified in suspecting an obstruction below any of those uncovered, a concretion in the ampulla of Vater, a stenosing pancreatitis, or inflammation of the sphincter of Oddi. In any case the ampullar stone is the more probable, and one is justified in resorting to a transduodenal papillotomy.

One of the most difficult problems is the differentiation between the obstruction due to stone accompanied by a psuedotumor, that is, the matting together by adhesions of the epiploon, colon, gastric antrum and pylorus, pancreas and bile sac, and a true neoplasm. Here again, however, the author holds that operative cholangiography will be of assistance, in that in the obstruction by stone the injected shadow material surrounds the concretion and reveals the lacunar characteristics of this form of obstructing body, while in the neoplastic type of block the hindrance to the flow of iodo-acetate will be complete. JOHN W. BRENNAN, M.D.

Robertson, H. E.: Silent Gallstones. *Gastroenterology*, 1945, 5: 345.

The author gives a very comprehensive historical review of the literature concerning gall stones. He surveyed the results of postmortem studies of the gall bladder made at the Mayo Clinic during the 10 years from 1934 to 1943 on persons over 20 years of age. A total of 1,027 had gall stones, 497 males and 530 females. In this study no attempt was made to determine the percentage of patients who at postmortem did not have, and apparently never had, gall stones. The author with a coauthor found that of 16,936 postmortem examinations at the same clinic in the years from 1910 to 1942, 16.3 per cent (12.6 per cent in males and 22.6 per cent in females) revealed that the person had or had had gall stones. In the present review the histories of these patients were carefully reviewed and it was found that in 626 (61%) there apparently had been no suspicion by the patients or their attending physicians that gall stones had been present. The remaining 400 cases could be fitted into various and sometimes overlapping categories; for example, 305 of the patients had undergone one or more operations for gall stones while in 80 cases stones were discovered accidentally at laparotomy for some other condition.

The assertion by some physicians that a certain percentage of "silent" gall stones in any given series is a reflection on the diagnostic abilities of the attending physicians is unwarranted. After gall stones have been accidentally discovered the attribution of the symptoms and signs to their presence is not always on a sound clinical or pathological basis. About 50 per cent of gall stone cases remain unrecognized. Not all gall stones discovered during life warrant operation for their removal; they are an individual problem in each instance and are usually accorded that importance which the best welfare of the patient warrants.

EARL O. LATIMER, M.D.

Skelton, M. O., and Tovey, G. H.: Congenital Obliteration of the Bile Ducts and Icterus Gravis Neonatorum. *Brit. M. J.*, 1945, 2: 914.

The authors state that icterus gravis neonatorum and congenital obliteration of the bile ducts may both be associated with biliary obstruction. In the former condition the canaliculi may be plugged by bile thrombi, probably as the result of damage of the hepatic cells. Once these thrombi have formed they may aggregate to produce an obstructing mass in the extrahepatic bile ducts, the final effect being to add an obstructive element to the jaundice caused by the hemolysis. Occasionally the biliary epithelial cells become swollen, and this tends to aggravate the condition. Desquamated epithelial debris lying free in the lumen of the bile ducts may add further to the obstruction. In some cases of icterus gravis of long standing, biliary stasis may occur and produce a picture of hepatic cirrhosis which is very similar to that of congenital obliteration.

Two cases of icterus gravis are described, in which obstruction was believed to have been due to blocking of the large bile ducts with inspissated bile. In one case the plug was dislodged at operation. The fathers of both patients, as well as the patients themselves, were rhesus positive. The mothers were rhesus negative with Rh antibodies in their blood.

The authors describe 2 other cases of congenital fibrosis of the bile ducts, in both of which there was a rhesus incompatibility demonstrated in the parents. Two siblings of one of these parents, born subsequently, died of jaundice. The findings at autopsy included erythropoiesis and kernicterus in both cases.

It is not suggested that all cases of congenital obstruction of the bile ducts are associated with erythroblastosis fetalis, but the fact that some of them appear to be associated with icterus gravis neonatorum is of practical importance. Consequently, any family showing a history of congenital obliteration should be examined for evidence of rhesus incompatibility. Only in this way can preparations be made to anticipate hemolytic disease which may occur in subsequent children.

As a prophylactic measure in patients with icterus gravis, the practice of massage over the region of the gall bladder is recommended in the hope of avoiding plugging of the bile ducts and hence obstructive jaundice. THEODORE B. MASSELL, M.D.

Smith, H. G., Pratt-Thomas, H. R., and Mace, L. M.: Re-Establishment of Pancreatic Secretion into the Intestine after Division of the Pancreas; An Experimental Study. *Arch. Surg.*, 1945, 51: 164.

As a result of progress in the radical operative treatment of carcinoma involving the head of the pancreas and the periampullary region, pancreatic cancer can be approached today with a clearer concept of the operative technique and with a reasonable chance of accomplishing a surgical cure.

Despite widening experience with this difficult surgical problem, the incidence of postoperative complications remains high. Some of the more distressing postoperative sequelae are referable to the stump of the divided pancreas and consist of external pancreatic fistula, acute pancreatic necrosis, retention cyst, and chemical or "enzymatic" peritonitis. The pancreatic stump has been handled, generally speaking, by one of two methods: occlusion by inversion of the sutures, with or without ligation of the duct of Wirsung; and some form of pancreaticoenterostomy, in which the stump is implanted into a segment of intestine. As regards the first method, digestion of the inverting sutures occurs all too frequently, with resulting leakage of the pancreatic juice and the consequent development of one or more of the complications mentioned. As to the second method, the question has been raised whether reimplantation of the pancreatic duct into the gastrointestinal tract is necessary, inasmuch as it is well established that many patients live normal, healthy lives after being deprived of the external secretions of the pancreas. On the other hand, many such patients suffer severely from disturbances of fat digestion in the form of steatorrhea and malnutrition, so that it is important, whenever possible, to maintain the external secretory function of the pancreas. An evaluation of techniques of pancreaticoenterostomy employed by various investigators directs attention to two important factors: all procedures (with the exception of Cattell's simple method) involve an open anastomosis, with a consequent breach in asepsis; and most of them are too time consuming. This experimental study was conducted in order to develop an aseptic technique which can be performed with minimal loss of time and preservation of the external pancreatic secretions.

Experiments were done on 22 dogs. In 15 animals the pancreas was divided at the junction of the uncinate process and the body without disturbing the relationships of the latter to the duodenum and thereby leaving the junction of the main pancreatic duct intact. The exposed transected surface of the pancreatic body was closed with sutures after ligation of the duct. In this manner the uncinate process was isolated entirely from the remainder of the gland, and its independent blood supply was maintained. The divided end of the duct in the uncinate process was allowed to retract into the parenchyma of the gland without its being ligated. The stump of the divided uncinate process was then implanted into the jejunal wall in an incision that extended down to, but not through, the jejunal mucosa, and was made secure in the jejunal wall by fine sutures. The remaining 7 animals were operated on by a modification of the technique of Cattell. The procedure was similar in detail to that described, except that the uncinate duct was dissected free so as to protrude from the divided stump of the gland. A crushing ligature of fine surgical gut was tied about the protruding duct and one end of the ligature was passed as a suture through the exposed jejunal submucosa and tied firmly to the other end, which brought the duct against the mucosa in a firm, necrotizing ligature. The pancreatic stump was secured into the jejunal wall in the usual manner. All animals survived and remained in good condition. Observations of the state of the pancreaticoenterostomy were made at intervals varying from 7 to 48 days by the following technique:

The abdomen of each dog was reopened under anesthesia and the jejunum adjacent to the pancreatic attachment was opened widely, which exposed to inspection the jejunal mucosa at the site of the pancreatic implantation. A concentrated, highly active preparation of secretin was then injected into the vena cava. If a fistula had developed from the uncinate stump into the jejunum, pancreatic juice could be seen grossly dripping from the fistular orifice in the mucosa. If fistula formation had not occurred, no response to the secretin was noted. The potency of the secretin was tested by opening the duodenum and observing simultaneously the flow of bile and pancreatic juice from the ampulla of Vater. Of the 22 animals studied, 15 showed definite secretion of pancreatic juice at the pancreaticojejunal junction after the intravenous injection of secretin.

After the functional status of the pancreaticojejunal junction had been determined, the entire uncinate process and the attached jejunum were excised for microscopic study, with particular reference to acute pancreatitis, pancreatic fibrosis, and the development of pancreaticojejunal fistulas. None of the animals showed gross evidence of active peritonitis or fat necrosis. There was some evidence of acute pancreatitis in 27 per cent of the animals, but pronounced diffuse pancreatitis was found in only 2 animals. Each of these animals appeared to be quite healthy. Some degree of scar tissue formation was demonstrable in 91 per cent of the animals, but fibrosis was considered pronounced in only 1 animal. This animal presented an indurated and atrophic stump, but no microscopic evidence of fistula. Despite these findings, the response to secretin was positive, although the flow of pancreatic juice was sluggish. Definite microscopic evidence of a junction between the mucosa of the uncinate duct and the mucosa of the jejunum was detectable in 59 per cent of the animals. It is pointed out that a fistula may exist despite failure to demonstrate it microscopically by the secretin test and also by the injection of water through the

uncinate duct into the jejunum. No external pancreatic fistula was encountered and only 1 retention cyst which complicated the procedure was found.

JOHN L. LINDQUIST, M.D.

Varco, R. L.: A Method of Implanting the Pancreatic Duct into the Jejunum in the Whipple Operation for Carcinoma of the Pancreas. *Surgery*, 1945, 18: 569.

The author presents a technique for anastomosing the pancreatic duct to the bowel in cases of resection of the head of the pancreas. This procedure has now been successfully carried out in 4 patients.

The pancreatic duct is isolated with a short extraglandular section preserved when the gland is transected. Two fine silk sutures are placed in the wall of the duct to hold it open. A two-holed catheter, somewhat larger than the duct, is selected—about a size 12. Eight centimeters of the catheter are stretched over a Keith skin needle, which serves as an obturator, and impaled at a point on the catheter wall slightly eccentric to the tip. As the segment of

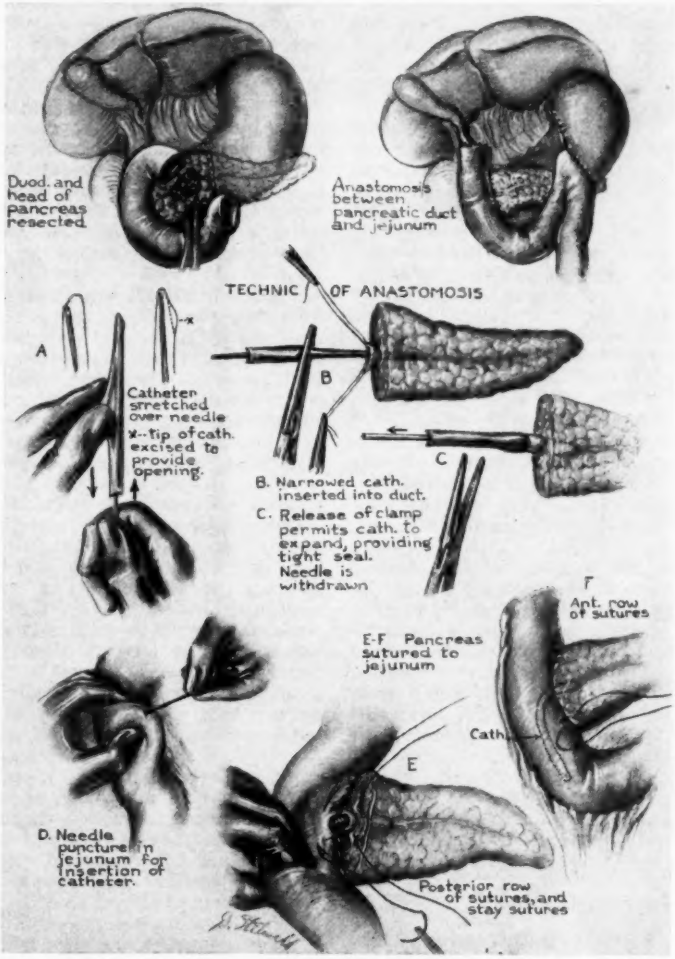

Duod. and head of pancreas resected
Anastomosis between pancreatic duct and jejunum
TECHNIC OF ANASTOMOSIS
A
Catheter stretched over needle
x--tip of cath. excised to provide opening.
B
C
B. Narrowed cath. inserted into duct.
C. Release of clamp permits cath. to expand, providing tight seal. Needle is withdrawn
F
Ant. row of sutures
E-F Pancreas sutured to jejunum
Cath.
E
D. Needle puncture in jejunum for insertion of catheter.
Posterior row of sutures, and stay sutures

Fig. 1. The two drawings at the top indicate approximately the site involved by malignancy and diagram the visceral configuration in the completed procedure, based on the Dennis plan of operation for carcinoma of the head of the pancreas. The technique of implanting the pancreatic duct into the jejunum is shown in sketches A to F.

catheter is stretched over the obturator its transverse diameter is decreased. It is held stretched by clamping the tube and obturator firmly with a hemostat. An oblique section is now cut from the tube, care being taken to place this distal to the tented wall of the catheter. The stretched catheter is slipped a short distance into the pancreatic duct and on release of the hemostat the catheter is permitted to resume its normal diameter and it is snugly held in the duct. A fine ligature may, if desired, be used to hold the extraglandular duct against the catheter, but usually this is unnecessary.

With fine sutures the posterior capsule of the pancreas is sutured to the jejunum at the site selected for anastomosis. A fine puncture hole is made with a Keith needle through all layers of the bowel wall and the catheter is forced through this small puncture wound into the lumen of the bowel, which gives a very close fit. Two fine sutures are placed between the connective tissue adjacent to the duct and the serosa next to the puncture site. The remainder of the capsule of the pancreas is sutured to the bowel serosa, namely, the anterior aspect.

In 4 cases in which this method has been used there has been no pancreatic fistula.

EARL O. LATIMER, M.D.

Wakim, K. G., and Mason, J. W.: The Effects of Adrenalin and Nembutal Anesthesia on Blood Constituents Before and After Splenectomy. *J. Lab. Clin. M.*, 1946, 31: 18.

The authors studied the effect of adrenaline and of nembutal anesthesia on the concentration of hemoglobin and plasma proteins, and on the red and white blood cell counts in intact and splenectomized dogs. The lateral surface area of the spleen was determined under nembutal anesthesia before and after the administration of adrenaline.

They found that the intravenous administration of adrenaline increases the concentration of hemoglobin and the red cell count in the circulating blood to a much greater extent in intact than in splenectomized dogs. Nembutal anesthesia causes hemodilution with a reduction in the hemoglobin concentration and in the red cell count, and a slight reduction in the plasma protein concentration. The size of the spleen in dogs under nembutal anesthesia was decreased about 66 per cent by the intravenous administration of adrenaline. The blood squeezed out by the spleen during its contraction under the influence of adrenaline had an average hemoglobin concentration about 11 per cent higher than that of jugular blood.

EARL O. LATIMER, M.D.

MISCELLANEOUS

Bradford, B., Jr., Battle, L. H., Jr., and Pasachoff, S. S.: Abdominal Surgery in an Evacuation Hospital. *Ann. Surg.*, 1946, 123: 32.

The observations presented were made on 341 abdominal war wounds operated upon in a single evacuation hospital from the middle of June, 1944 through December, 1944 in the European theatre. The distance of the hospital from active fighting varied from 4 to 30 miles. The cases include all of those with penetrating and perforating wounds involving the peritoneum, perforating wounds of the rectum, and major retroperitoneal injuries requiring celiotomy.

The diagnosis of intra-abdominal perforation was usually obvious in battle casualties. Signs of peritoneal irritation were frequently absent during shock, but appeared when it was relieved. Symptoms of peritoneal irritation appeared late in wounds of the left colon, and a silent abdomen was the rule when peritoneal irritation was present. Shoulder pain was not important, and the absence of liver dullness was not a constant finding. Proctoscopy and sigmoidoscopy were invaluable in uncovering rectal and sigmoid perforations. Location of the foreign body roentgenologically was helpful. Urinalysis was a routine procedure in all cases of abdominal injury and, with catheterization, was useful in exposing wounds of the urinary tract. When in doubt as to whether intraabdominal perforation existed, an exploratory laparotomy was done.

Preoperative management is stressed as being frequently the decisive factor in the outcome of cases of abdominal injury. All patients were sent to the shock ward first, whether shock existed or not. Both blood and plasma were used, but the former was believed to be of most value, and a quantity of 1 liter or more was usually necessary to relieve shock in individual cases. Patients with active intra-abdominal bleeding and abdominal evisceration were sent directly to surgery with blood running because they did not respond to shock therapy until surgery was done. In judging the optimum time for surgery, the patient's general condition and skin warmth were valuable aids. Single blood pressure readings were misleading, but multiple readings were helpful. However, patients with a blood pressure of below 80 systolic did not tolerate surgery well. The time interval before surgery was not found to be important except in cases of continued bleeding and evisceration at intervals, and some patients under shock therapy were operated upon as late as 36 hours after injury; however, the policy was to give all patients the benefit of surgery whether or not they responded to shock therapy.

The mortality in the cases of patients who were operated upon 6 hours from the time of injury was 30 per cent. The mortality dropped in the subsequent six-hour periods until, at the 24 to 30 hour period, it was but 10 per cent. The high early mortality was partly explained by the fact that the most desperate cases were operated upon first.

Where multiple major wounds existed, the policy was to perform the separate procedures over a period of days rather than have several operative teams working at the same time.

In most cases the anesthetic of choice was nitrous oxide, oxygen, and ether in a closed system, prefer-

ably with intratracheal intubation. Open drop ether was valuable for patients in severe shock from internal hemorrhage. Spinal anesthesia and pentothal were unsatisfactory.

In combined chest and abdominal wounds, the thoracic problem was handled first. The transthoracic approach to the diaphragm was most useful in treating wounds of the diaphragm, spleen, and some gastric wounds. Paramedian incisions with separation of either of the recti muscles were used most frequently. Exposure through subcostal incisions proved very useful especially in cases with injuries of the stomach, liver and spleen, and the hepatic and splenic flexures of the colon.

The authors state that systematic examination of the abdominal contents is important. Suture of wounds of the small bowel is preferable to resection, and end-to-end suture was the procedure of choice following resection. Enterostomy of the small bowel should not be done.

Small wounds of the cecum and ascending colon were sutured, and a large Pezzar catheter was placed in the cecum as a safety valve. In the transverse, descending, and sigmoid colon the Mikulicz or, preferably, the loop-type of colostomy was performed. In rectosigmoid perforations, those within the peritoneal cavity were sutured with a proximal inguinal sigmoidostomy to divert the fecal stream. In extraperitoneal perforations of the rectum, adequate drainage with removal of the coccyx, if necessary, and a proximal colostomy, were done.

Wounds of the liver were managed by packing, or the use of free muscle grafts. Wounds of the spleen usually required splenectomy.

Abdominal incisions were carefully closed in layers and reinforced with silk or wire retention sutures. Drainage of the peritoneal cavity was unnecessary except in cases of wounds of the liver.

Postoperative care included adequate hydration and the liberal use of plasma and whole blood to maintain blood protein levels. Wangensteen drainage was used routinely in all postoperative abdominal cases. Prostigmine was given prophylactically in the immediate postoperative period. Vitamin C and thiamin were given orally. Penicillin was used routinely in all cases and is given partial credit for the low incidence (1.6 per cent) of pulmonary infections. Postoperative wound infections were rarely encountered, and this was attributed to the use of penicillin and the sulfa drugs; also, postoperative intestinal obstruction in the early postoperative period, even after extensive surgical procedures, was rare.

FREDERICK C. HOEBEL, M.D.

GYNECOLOGY

UTERUS

Eisen, D., and Goldstein, J.: Lipiodol Intravasation during Uterosalpingography with Pulmonary Complications. *Radiology*, 1945, 45: 603.

The accidental intravasation of lipiodol into the venous system of the uterus during uterosalpingography has been repeatedly described in the literature. As a rule there were no ill effects, except perhaps slight temporary leucocytosis. In rare cases, pulmonary and cerebral embolism and pulmonary infarction were noted.

In an attempt to study the mechanism of lipiodol embolism in the lungs, Sicard and Forestier injected from 2 to 4 c.c. into the cubital vein. The lipiodol reached the lungs in 5 or 6 seconds, remained there for from 6 to 8 minutes and then suddenly disappeared. The only effect in the patient was a slight cough. Walther injected lipiodol into the ear vein of rabbits. He found that practically all of the oil became arrested in the lungs where it underwent two processes. The major part was broken up into iodine and fat, the iodine being excreted through the kidneys during the first 8 days as potassium iodide, and the fat being saponified and carried away by the circulation. A smaller part of the lipiodol became phagocytosed. Walther also suggested that an inflammation may develop around fat droplets because of bacteria carried along by the lipiodol from the uterus.

Fig. 1. Lipiodol intravasation into the uterine venous plexus and the ovarian veins. The latter resemble ureters, being filled in their entirety, on the right side to the vena cava and on the left up to and including the renal vein.

A review of the literature revealed that the various authors attributed the intravasation to trauma of the endometrium during the injection, to excessive pressure, and to an increased permeability of the receiving sinuses, such as is observed in idiopathic uterine bleedings or immediately after menstruation.

The authors themselves noted intravasation of lipiodol during uterosalpingography in a woman 28 years of age. The case is briefly described and illustrated (Fig. 1). The afternoon after the injection the patient developed a dry cough with a temperature of 102 degrees. The next day her cough increased and she brought up bloody sputum. The temperature remained high until the fourth day when it dropped to normal. The cough persisted, however, and a roentgenogram of the chest on the ninth day revealed a dense patchy opacity involving the lower two-thirds of both lungs. Another roentgenogram 1 month later showed practically a normal appearance.

In conjunction with this case the authors recommended the following precautions: (1) uterosalpingography should not be performed sooner than from 8 to 10 days after the menstrual period or any operation on the uterus; (2) the position of the uterus should be determined preliminarily by the use of a sound and in case of angulation the injection should be done by properly circumventing the angulation so as to avoid trauma to the endometrium; (3) the pressure of the injection should not exceed from 180 to 200 mm. of mercury; a manometer being used for control; and (4) the amount of lipiodol injected should be no more than is necessary to fill the uterus and tubes, with a slight spill.

T. Leucutia, M.D.

Morris, P.: Hydrometrocolpos in Infancy—A Cause of Urinary Retention, Intestinal Obstruction, and Edema of the Lower Extremities. *Am. J. M. Sc.*, 1945, 210: 751.

A 7 weeks old girl, who had been passing thin ribbonlike stools with difficulty for about 3 weeks, and for a day had only slightly wet two diapers, suddenly developed swelling of the feet and a purplish discoloration of the lower extremities. Also, the previous day blood flecks had appeared in the stool and intussusception was suspected because of the presence of a mass in the lower abdomen. In

addition to the large cystic mass extending upward from the pubis and apparently slightly more toward the right side, reaching to 2 cm. above the umbilicus, there was a peculiar bulge at the vulva, cystic in appearance, pointing anteriorly and somewhat resembling a rectocele with the distended viscus pushing into it.

At laparotomy, after the bladder had been emptied by catheterization, a second mass appeared behind it. This was recognized as the distended uterus and vagina. Pressure on this mass, which was only about 5 cm. in diameter, caused an increased tension in the vulvar bulge which was then incised externally. A considerable amount of a thin, slightly milky fluid escaped, and the mass collapsed, which allowed the rest of the urine to be emptied easily from the bladder. The fluid contained some white blood cells but the culture was sterile. The child died about a week later, death apparently having nothing directly to do with the abnormal condition reported.

The author thinks that patients with hydrometrocolpos should not ordinarily be subjected to laparotomy, as simple incision of the vaginal membrane entirely relieves the condition. Preliminary aspiration by needle of some of the cyst fluid and injection into the cyst of 20 c.c. of diotrast followed by anteroposterior and lateral roentgen ray views (as suggested by Mahoney and Chamberlain,(*J. Pediat.*, 1940, 17: 772) will clearly establish the diagnosis of the condition.

The author wonders if many of these patients are not escaping detection as the condition becomes more or less quiescent about 2 weeks after birth when the glandular activity of the vagina and cervix regresses with exhaustion of the store of circulating estrogen left by the mother. With an imperforate condition of the hymen or residual embryonic vaginal septum, as the case may be, the condition may develop again about the time of puberty and lead to the later development of the not infrequently observed hematocolpos of the adolescent girl.

JOHN W. BRENNAN, M.D.

Calvo, M., and Botella, J.: Hormonal Conditions in Uterine Myoma and the Genesis of the Menstrual Disturbances in Myomatous Women (Sobre las condiciones hormonales en el mioma de útero y la génesis de los trastornos menstruales de las miomatosas). *Rev. espan. obst.*, 1945, 3: 87.

This article is the third of a series of publications by these same authors in preceding numbers of this same journal, of which the first (Calvo y Botella: Rev. espan. obst., 1944, 1: 1) demonstrated the predominance (four-fifths of the patients with myoma) of incomplete cycles, that is, persistent follicles and anovular cycles. The second (Ibid., 1944, 1: 165) showed that in almost three-fourths of the myomatous women the secretory phase of the menstrual cycle did not develop. These findings corresponded closely to those in the first article. In addition, the reader is referred to the thesis of one of the authors (Calvo Marcos: Tesis doctoral, Madrid, 1943) for a detailed discussion of the techniques employed in this series of investigations.

In the two previous articles the investigations had led the authors to believe that there is actually an inundation of the blood of the myoma patient by estrogenic hormone, viz; that the blood hormone is higher than normal, although the excess seems due rather to a constancy of secretion (anovular cycle) than to a high titer at any one phase. This constancy of secretion is designated by the authors as a rhythmic hyperestronism. It also seemed to them that the pathological bleeding so characteristic of the myoma has a functional origin, that is, it is bound up with the endometrial functional changes incident to normal menstruation.

In this report, on the other hand, there are presented the shortcomings in the authors' findings, militating against unqualified acceptance of any such conclusions as those just cited.

The urine of 8 myomatous patients was tested for the elimination of estrogenic hormones on castrated adult white mice according to the method of Siebke, and, although it is admitted that the urinary estrogenic elimination is not now regarded as a reliable criterion for indicating its level in the blood, it was found that the urinary elimination was neither constant nor excessive. In only 2 instances was the titer higher than normal and even in these cases the excessive elimination was not very marked, and the tentative inference is offered that the endocrine disturbances of the myoma are due rather to the continuity of follicular secretion (anovular cycle) than to an actual increase in quantity at any particular time.

In studying their material the authors found that the incidence of the various patterns of menstrual manifestations in myoma showed, in accord with practically all statisticians on this subject, a rather striking correlation of figures under all conditions. In their own material there was more than 50 per cent of patients complaining of menorrhagias, more than 10 per cent with metrorrhagia, 3 per cent with eumenorrhagia, and 4 per cent with amenorrhea, and these proportions of characteristic manifestations were maintained, except perhaps for a slight predominance of copious menorrhagias in the frankly hyperplastic endometrial specimens, no matter what endometrial phase was present.

The authors, therefore, conclude from these studies that the bleeding in these myomatous patients is not due to a hormonal metropathy, but rather to a vascular condition. In conformity with the older theories, it is believed that it is due to the power of the myomatous new growth to induce congestion and changes in the capillary walls in the tissues overlying and contiguous to it. This perhaps is dependent upon its ability to produce some substance such as histamine or histaminoid substances, and the effect is perhaps more or less sustained by the poor contractility and cavity deformation which is presented by the uterus itself.

JOHN W. BRENNAN, M.D.

ADNEXAL AND PERIUTERINE CONDITIONS

Jones, G. E. S., and Te Linde, R. W.: The Curability of Granulosa Cell Tumors. *Am. J. Obst.*, 1945, 50: 691.

Three cases of granulosa cell tumors have been reported in which recurrences developed not less than 14 years after the original operation.

All 3 patients died, 18, 20, and 21 years, respectively, following the removal of the primary tumor, in spite of the fact that the tumors were well encapsulated and showed no evidence of metastasis or implantation at the original operation. One tumor recurred in spite of bilateral salpingo-oophorectomy and hysterectomy.

One case, with widespread inoperable abdominal metastases, responded well to deep x-ray therapy over a period of 3 years, but a subsequent recurrence of the growth proved refractory to treatment.

The total urinary estrogen values in 2 cases were not extremely high but stood within the range of values for normal cyclic women. However, the values were well above those usually found in the authors' laboratory for postmenopausal women. All 3 of the patients fell into this age group at the time of the tumor recurrence. All 3 cases exhibited clinical signs of estrogenic activity at that time.

EDWARD L. CORNELL, M.D.

Usandizaga, M.: Tumors of the Round Ligament (Los tumores del ligamento redondo). *Rev. espan. obst.*, 1945, 3: 75.

The author's patient was a woman of 39 years, who had been married for 18 years and had gone through 3 pregnancies with normal childbirth in each instance. She entered the Provincial Maternity Hospital at Zaragoza with progressive enlargement of the abdomen since about 5 months previously, and rather mild pains in the hypogastrium radiating into the lumbosacral region.

Examination revealed a hypogastric mass, somewhat smaller than the head of an adult person, of hard consistency, very firmly fixed, and with an irregular nodular surface. The impression of a small retroposed uterus was also obtained. The diagnosis was that of an intraligamentary, solid tumor.

At operation a tumor mass was uncovered; it was somewhat smaller than an adult man's head with multiple lobulations and of firm consistency; it was situated almost entirely beneath the peritoneum. The mass appeared to be in direct continuity with the uterine end of the round ligament on the right side, the ligament passing intact from the uterus for about 3 cm. before being engulfed by the tumor mass. The broad ligament was well preserved, the tube and ovary of that side presenting a normal appearance. The peritoneum was freely movable on the surface of the tumor, and the latter was easily enucleated. The uterine segment of the round ligament was sectioned and the enucleation carried to the region of the internal inguinal ring where a small vascular pedicle was likewise cut and tied. The tumor could then be lifted out, and the exact impression was given as though the round ligament had been excised between ligaments for its entire extent. This was followed by peritonealization, closure of the abdomen, and an eventless postoperative course.

Histological examination of the tumor disclosed that its texture consisted of abundant trabeculae of smooth muscle cells in a framework of fibrous tissue.

An extensive bibliography is appended to this report of an extremely rare form of tumor.

JOHN W. BRENNAN, M.D.

EXTERNAL GENITALIA

Quinet, A.: Tuberculosis of the Vulva and Cervix—Contribution to the Medical Statistic of Brazil (Tuberculose da vulva e cervix—contribuição à casuística nacional). *An. brasil. gin.*, 1945, 10: 1.

The case of a negro woman of 34 years, who had given birth to 7 full term children, is here reported. It was one of the relatively rare instances of tuberculosis which attack the female sexual organs and one of the even rarer exemplars of the disease in which the attack was made on the cervix of the uterus. Finally, it was one of the very rare cases in which the vulva was involved in the tuberculous ulcerative condition; in fact, the author states that this is the first instance of vulvar involvement to be reported in the medical literature of Brazil.

The patient visited the out patient department (medical division) of the Hospital Moncorvo Filho in Rio de Janeiro, a year and 2 months after the birth of her last child, complaining of physical and mental exhaustion and weakness, loss of weight, and pains in the region of the lower abdomen which became worse on exertion. Physical examination at this time disclosed some disseminated subcrepitant rales in the chest but no evidence of any involvement of the pelvic organs. A month later, however, the pains had become worse; the patient entered the hospital and was assigned to the medical section, where a small amount of ascites was determined and a hemorrhagic liquid, showing no trace of the Koch bacillus, was aspirated from the right pleural cavity. Paracentesis of the abdomen likewise yielded an ascitic fluid without trace of tubercle bacilli.

At the end of 2 months the effusions had cleared up and the pains were gone; however, the vaginal discharge was very marked and the patient was sent to the gynecological division. Here large, irregular, fixed masses were found on both sides of the cul-de-sac of Douglas, and since one of these had begun to enlarge and soften, the patient was transferred 15 days later to surgery, where the intrapelvic process developed to the point where the uterus and other pelvic organs became enveloped in a single tumor mass.

At laparotomy, some time later, 2 liters of caseous, purulent material, rather fetid and of a yellowish-green color, were aspirated from the mass in the pelvis, and a biopsy specimen was taken from the

lining membrane of the pus pocket. On histological examination this specimen confirmed the suspected diagnosis of tuberculosis. No further surgical procedures appeared possible and the abdomen was closed.

It appears that it was during this later period that there developed from the anterior lip of the cervix the indolent appearing ulcerative process, with sharply punched out edges and sluggish, lardaceous floor, which spread down the anterior wall of the vagina, and one patch, about ¾ inch in diameter, appeared on the internal aspect of the left labium major.

Biopsy specimens from the vulva, portio vaginalis, endometrium, and endocervix disclosed (as depicted in excellent photomicrographs in the original article) the vascular characteristics, lymphoid, plasma, and Langhans cells, as well as the scattered alcohol resistant bacilli of tuberculosis. The mycobacterium tuberculosis was cultured on Lowenstein medium and guinea pig inoculations proved positive.

JOHN W. BRENNAN, M. D.

MISCELLANEOUS

Dujovich, A.: Elytrocele (Elitrocele). *An. brasil. gin.*, 1945, 10: 116.

The elytrocele, also variously known as vaginal hernia, enterocele vaginalis posterior, Douglascele, prolapse of Froriep, hernia of the floor of the sac of Douglas, and colpocele posterior, is rare but nevertheless more frequent than the anterior form of vaginal hernia. It is particularly important not to confound this condition with rectocele since a simple repair of the latter, when accompanied by elytrocele, will usually result in recurrence. However, other forms of defect of the pelvic floor usually accompany the elytrocele. It is well to be prepared to repair these at the same time.

The case history presented by the author was that of a woman of 55 years who had given birth to 3 children. Twenty-nine years ago, 4 years after the first accouchement she had noted a protrusion of the vulva, which was painful on physical exertion. The condition became gradually more pronounced until 19 years ago, when she underwent a pelvic repair—probably an anterior colporrhaphy and a colpoperineorrhaphy—with relief for 4 years. Then the protrusion and other symptoms returned. A pessary was worn for 7 years without relief and during the past 2 years the patient suffered from a sensation of heaviness in the vagina, and on exertion a globular mass protruded from the vulva. The diagnosis at this time was genital prolapse, colpocele, anterior cystocele, hypertrophic elongation of the uterine cervix, colpocele, rectocele, and vaginal hernia of the pouch of Douglas (enterocele).

At operation, which was entirely vaginal, the anterior wall of the vagina, together with the cystocele, was first repaired, and the elongated cervix amputated. The incision was then carried around back of the cervical stump and the posterior surface of the latter was followed closely to guard against injury to the hernial sac. The sac, however, was easily identified and freed up to its neck. When the sac was opened, it was found to be lined with the peritoneum of the pouch of Douglas and to contain a loop of the sigmoid colon. The sigmoid was pushed back through the neck, 2 fingers in width, which was then closed by a purse string suture with No. 1 catgut, and the sac itself was cut away. The closure was, in turn, reinforced by additional sutures including the posterior surface of the cervix and the rectovaginal fascia on each side, which had been previously dissected loose from the posterior vaginal mucosa. The vaginal mucosa was then sutured with interrupted sutures of No. 2 catgut to the posterior surface of the stump of the cervix, and the entire operation finished up with repair of the residual rectocele, including the usual myorrhaphy of the levator muscles.

It is now a month since the patient was operated upon; although there is some shortening of the vagina, she seems to be definitely cured. Indeed, the prognosis is generally good in these patients, provided that the condition be correctly recognized.

JOHN W. BRENNAN, M.D.

OBSTETRICS

PREGNANCY AND ITS COMPLICATIONS

Dieckmann, W. J., Turner, D. F., and Ruby, B. A.: Diet Regulation and Controlled Weight in Pregnancy. *Am. J. Obst.*, 1945, 50: 701.

The pregnant patient must have a proper diet, but this does not mean that she should have an unlimited caloric intake and, as a result, gain excessively in weight. The pregnant patient does not have to eat for 2 of her own size. The diet must be increased during the last trimester.

The necessary weight gain due to the physiological changes of pregnancy—fetus, placenta, amniotic fluid, uterus, blood volume, breasts—amounts to 6.7 kgm. Chesley calculates from reports in the literature a gain of 6.2 kgm. for the same physiological changes in pregnancy. There is no need for a total weight gain greater than 8 kgm. above the ideal weight. The first 3 months of pregnancy are characterized by either a little gain or a loss of weight. The average weight gain for the remainder should then be a maximum of 225 gm. (½ pound) per week.

Every patient whose total weight gain is over 10.9 kgm. does not necessarily have toxemia. Statistics show, however, that the incidence of toxemia is increased in the patients who gain more than 13 kgm.

If the patient's weight is ideal before pregnancy, the maximum gain should be between 7 and 8 kgm. A diet containing 1,800 calories is required.

EDWARD L. CORNELL, M.D.

Lagercrantz, C.: Electrophoretic Analysis of Serum in Pregnancy and in Pregnancy Toxemia. *Upsala läk. fören förh.*, 1945, 51: 117.

An analysis of serum proteins in pregnancy and in pregnancy toxemia has been carried out previously by gravimetric, nephelometric, refractometric, or precipitation methods. These methods have shown quite consistently that during pregnancy both the concentration of serum proteins and the albumin-globulin ratio are lowered. These findings are more pronounced in toxemia, especially in cases in which there is much edema. Previous investigators, assuming that the well recognized increased plasma volume of pregnancy is due largely to a plasma hydremia, have suggested that the decreased protein content is in the main a dilution effect. Because this decrease in total protein is due solely to a lowered albumin, they have regarded the unchanged value of the globulin as an expression of an absolute increase of this protein in the plasma. In pregnancy toxemia where still lower albumin values are found, it has been suggested that these values are the result not only of further dilution but also of real loss of albumin. In the present study, serum proteins were analyzed by electrophoresis. The technique is carefully described.

Electrophoretic analysis was performed on serum from 16 normal nonpregnant women, 9 normal pregnant women in the second to seventh months of gestation, 12 normal pregnant women in the last month of gestation, and 19 pregnant women in the last month of gestation with varying degrees of toxemia. The analysis showed that:

1. The alpha and beta globulins increase both relatively and absolutely during normal pregnancy.
2. The albumin and total protein decrease during normal pregnancy.
3. Women with toxemia have a both relatively and absolutely larger alpha globulin than normal pregnant patients.
4. There is no significant difference in the electrophoretic patterns of umbilical cord serum after a normal pregnancy and after a toxemic one. Umbilical cord serum shows small amounts of alpha and beta globulins.

The author correlates these results with previous work, although he makes no attempt to draw any significant conclusions.

The alpha and beta globulins consist partly of lipids. It is known, of course, that in pregnancy the serum lipids are elevated. The increase in these globulin fractions may be related to the lipemia. In view of the small amounts of alpha and beta globulin found in the umbilical cord, it is unlikely that the increase is caused by a transfer from the fetus.

The molecular weight of both alpha and beta globulin is much higher than that of either albumin or gamma globulin. Consequently, in toxemia, when the permeability of the capillary walls may be pathologically increased, albumin and gamma globulin should leak through first and lead to a relative increase of alpha and beta globulin. The absolute increase, however, must be explained by some other factor than filtration alone.

L. JAMES TALBOT, M.D.

Gimeno, A. M., and Orengo, F.: Capillaroscopy in the Toxemias of Pregnancy, with Special References to Differential Diagnosis (La capilaroscopia en las toxemias de embarazo, con especial referencia al diagnóstico diferencial). *Rev. espan. obst.*, 1945, 3: 102.

This is the conclusion of an article begun in the July issue of this same journal in which details of the technique and the criteria established by the authors in judging the results of their observations will be found.

The authors examined capillaroscopically 100 cases of toxemia, including 3 of chronic nephritis, 5 of vasculorenal disease, 22 of essential hypertension, 47 of mild pre-eclampsia, 17 of severe pre-eclampsia.

and 5 of eclampsia. These capillaroscopic examinations were made in the course of a broader investigation employing numerous other tests and methods of study, such as blood pressure studies, and studies of edema, of the effects of the administration of pituitrin and of congelation, of the hematocrit findings, of albuminuria, and of sedimentation, and the results were correlated. When possible the observations were made both before and after delivery.

Capillary architecture does not show sufficient modification to permit of differentiation between the mild and the severe pre-eclampsias. Acute nephritis is distinguished by marked anomalies of form, such as undulation, serpentine formation, intercrossing, anastomosis, visibility of the subpapillar plexus of the blood vessels. There are no characteristic alterations in the picture of essential hypertension. In chronic nephritis and in vasculorenal disease deviations of form are, in the first instance, scarce (undulation, some serpentine deformities, and at times visibility of the subpapillar plexus). In the second condition there are even fewer abnormalities, consisting solely of a certain amount of diminution in the number of capillaries per field, each vessel being somewhat narrower on the whole.

In general it is possible to demonstrate a relationship between the clinical picture and the capillary findings; however, incongruities are frequently present. The blood current in acute nephritis can show findings as poor as those in eclampsia, and, by the same token, much worse than those in chronic nephritis. In cases of essential hypertension and in vasculorenal disease there is a persistent constriction of the vascular bed with changing blood current velocities and, at times, an accelerated or even violent circulation.

The postpartum capillaroscopic examinations result in two classifications: the genuine toxemias (pre-eclampsia and eclampsia) and a group comprising all the other processes cited (chronic). In the first group the authors observe a total recuperation or at least a tendency toward recovery; in the second, an established condition with slight modifications persists. The value of a careful postpartum revision for substantiating the diagnosis is seen.

The authors consider capillaroscopy a diagnostic method, which aids in the differentiation between genuine toxemias and vascular disease or a chronic kidney condition, especially when employed in the postpartum period. It also possesses a limited but evident value in prognosis and may serve as a guide in bringing out the effectiveness of therapeutic methods, the authors having frequently observed the improvement with diet, with magnesium sulfate, and especially with hypertonic glucose solution.

JOHN W. BRENNAN, M.D.

Davis, L. J., and Forbes, W.: Thiouracil in Pregnancy; Its Effect on the Fetal Thyroid. *Lancet*, Lond. 1945, 249: 740

A case of mild thyrotoxicosis in a woman who was treated with thiouracil prior to and during pregnancy is presented. She died in the sixth month of pregnancy. The cause of death was uncertain despite autopsy examination.

The thyroid gland of the fetus was enlarged and hyperactive, as compared with a presumably normal gland from a premature infant, and showed histological evidence of considerable functional activity. It resembled the gland of an adult receiving too much thiouracil. It is suggested that thiouracil acts on the fetal thyroid after passing through the placenta. The administration of thiouracil to pregnant women and probably to nursing mothers demands caution.

GEORGE BLINICK, M.D.

Beerman, H., and Ingraham, N. R., Jr.: Recent Advances in the Management of the Syphilitic Pregnant Woman. *Med. Clin. N. America*, 1945, 29: 1463.

There is now general agreement that syphilis is exclusively transmitted to the fetus by the mother. Most evidence shows that the fetus is infected in the later months of pregnancy and not shortly after conception.

Routine blood testing in prenatal patients becomes a matter of great importance because 90 per cent of the women are unaware of their infections. In the experience of the authors there is no evidence that pregnancy impairs the sensitivity or specificity of the tests.

In the treatment, drugs with a strong spirillicidal action must be used. These are neoarsphenamine, arsenoxide, and penicillin. Bismuth and mercury alone are not effectual. An outline for the use of these drugs is given, with the greatest discussion being devoted to penicillin. Treatment began at the fourth month of pregnancy and continued at weekly intervals to total not less than 4 gm. of neoarsphenamine, or the equivalent of arsenoxide, with or without bismuth subsalicylate. Pregnant women tolerate arsenical and heavy metal treatment well, but a urine examination and blood pressure determination before each treatment is important.

Penicillin therapy is the same as for the nonpregnant adult. The spirochaeta pallida was seldom found in the open lesions longer than 12 hours, and the lesion itself was completely healed in 1 week. The therapeutic shock at the beginning of treatment may be harmful to the fetus. A large percentage of the women develop abdominal pain, gastrointestinal disturbances, and on several occasions presented symptoms of threatened abortion. For this reason the initial dose is reduced for the first 48 hours. A total dosage of either 1,200,000 or 2,400,000 Oxford units of sodium penicillin is satisfactory both to prevent infection of the fetus and to cure the disease in the mother. This total dosage is given intramuscularly, 20,000 units every 3 hours, with a reduction during the first 8 hours. The total treatment course takes 8 or 9 days.

Twenty-seven of the women treated at the University of Pennsylvania Hospital, Philadelphia, have thus far been delivered and their babies followed up

for periods which vary from 2 months to a year with no evidence of syphilis.

CATHERINE B. HESS, M.D.

LABOR AND ITS COMPLICATIONS

Resnick, L.: Spinal Analgesia in Operative Obstetrics. *Brit. M. J.*, 1945, 2: 722.

Although the safety of spinal anesthesia for general surgery has been generally accepted, its use in obstetrics is still considered dangerous. The author reports a series of 137 cesarean sections and 256 operative vaginal deliveries done under heavy nupercain (1 in 200 in 6% glucose in 3 c.c. ampules) spinal anesthesia.

Premedication was given to all women who were to be delivered by cesarean sections; it consisted of omnopon gr. 1/3 and scopolamine gr. 1/300, given about 45 minutes before operation, and, in addition, atropine gr. 1/100 and ephedrine gr. 1; for vaginal deliveries most of them had had some premedication during the labor but were given ephedrine gr. 1.

The dosage for cesarean sections varied from 1.2 to 1.5 c.c. of the solution, and for vaginal deliveries from 0.5 to 0.8 c.c., which gave anesthesia to just below the umbilicus.

The indications for and the types of cesarean section performed are summarized; 75 per cent of the sections were of the lower segment type. Of the 256 vaginal deliveries 136 were made by means of the outlet forceps, 108 by midforceps, 8 by high forceps, 6 by breech extraction, and 4 by craniotomy. Rotation of the head was performed 167 times.

No maternal deaths occurred in the cesarean group, while 2 of the patients delivered from below died (one because of pulmonary embolus and the other following sulfonamide therapy for pyelitis); in neither case was the anesthesia responsible for the death. Seven (5%) of the cesarean babies and 34 (13%) of those delivered from below died, but none of these deaths could be attributed to the anesthesia.

The author considers the following to be the advantages of spinal anesthesia:

For the mother

1. It is safe when inhalation anesthesia is contraindicated.
2. It is safe in pre-eclampsia and eclampsia.
3. It is safe in essential hypertension.
4. Uterine atony and hemorrhage are rare.
5. Obstetric shock is rare.
6. Pulmonary complications are rare.
7. Postoperative discomfort is absent.

For the physician

1. The technique of its use is simple.
2. It may be used when skilled anesthetists are not available.
3. It affords maximal relaxation of the pelvic muscles.
4. No additional anesthesia is needed for repairs.

The contraindications to spinal anesthesia are:

1. Cases in which the central nervous system or spinal disease interferes with aseptic technique.
2. Abnormal presentations.
3. Blood pressure below 100 mm. of mercury.
4. Acute shock.
5. Acute heart failure.
6. Constriction ring dystocia.

J. ROBERT WILLSON, M.D.

NEWBORN

Wiswell, G. B.: Anemias of the Newborn. *Canad. M. Ass. J.*, 1945, 53: 555.

Anemia is defined as any state in which the hemoglobin is less than normal in proportion to the blood volume. This state can arise from several causes such as blood loss, failure of cell formation or hemoglobin, excessive cell destruction, or combinations of these.

These anemias are reviewed under four headings:

Anemia due to hemorrhage. Hemorrhage may be suspected if the red cells drop to 4,000,000 with a corresponding reduction in hemoglobin. It is a hypochromic type becoming microcytic if the loss continues. Nucleated red blood cells appear and the reticulocytes increase. The leucocytes increase to from 20,000 to 30,000 and the platelet count is normal or raised.

Traumatic hemorrhage usually occurs in the first two days and may be severe enough to cause anemia.

The two most common diseases of the newborn giving rise to spontaneous hemorrhage are:

Hemophilia, which is rare. The clotting time may be prolonged for hours but the blood eventually clots. Treatment consists of frequent transfusions.

Hypoprothrombinemia. This is very important and takes the form of constant oozing. It usually appears between the second and eighth day. Marked increase in the prothrombin time alone characterizes this condition. Vitamin K administration to the mother in labor or intramuscular injection of the newborn is remarkably efficacious in preventing or benefiting this condition.

Anemia of infection. The hematopoietic systems of babies vary in their vulnerability to infection. Anemia lowers the resistance to infection and infection aggravates the anemia. Severe pyogenic infections, septicemia, pyelonephritis, and pneumonia may cause a serious drop in hemoglobin. Streptococcal and bacillus coli infections are more likely to cause anemia than streptococcal infections although a hemolytic staphylococcus may cause severe anemia even of an aplastic type.

Congenital syphilis is the chief offender of the chronic infections.

Acute congenital hemolytic anemia may rarely follow infection, and sickle cell anemia, occurring only in negroes, may be precipitated by infection.

Repeated transfusion is the treatment of choice and if the anemia persists there has probably been some destruction of the bone marrow.

Anemia of prematurity. This type is characteristic of all immature infants and its severity is governed by the state of maturity. The anemia may not reach its maximum for from 8 to 10 weeks and at 3 months a gradual improvement sets in. Various workers have shown that iron is not directly involved in the causation of this anemia. Immaturity of the hemopoietic system makes it difficult for these infants to perform postnatal adjustments and to recover the normal volume of blood and its constituents.

In the early stages it is a normocytic normochromic anemia. Microcytosis occurs later. The prothrombin time is often increased.

These babies are potential bleeders and they require vitamin K more urgently than normal infants. Treatment with iron is of some use only after the third month at which time there is a natural spontaneous tendency toward recovery. Transfusion has only a transitory effect and is used only to combat infection and complications.

Anemias due to hemolysis. These are for the most part related to the Rh factor and its workings. The author gives a good review of the mechanism by which Rh incompatibilites cause hemolysis of the blood cells in infants and subsequent anemias. The hemoglobin may fall to 20 per cent and the red blood cells to 1,000,000. The treatment is multiple transfusions of Rh negative blood.

HARRY FIELDS, M.D.

MISCELLANEOUS

Tompkins, P.: The Timing of Ovulation with Basal Temperature Graphs. *Med. Clin. N. America,* 1945, 29: 1425.

Graphs of the daily basal body temperature have been used by the author as an index to ovulation in cases of sterility. Special graph paper or improvised paper is suitable. The patient is instructed to take her temperature rectally with an ordinary clinical thermometer each morning upon awakening, and before rising, drinking, eating, and smoking. It is to be recorded if any acute infection exists at the same time, although marked upper respiratory infections produced practically no change in the rectal temperature. The results of this method concur with the established theory that ovulation occurs on the fourteenth day before the menstrual period, regardless of the intervals of the periods.

The time of ovulation is marked by a rise in rectal temperature, which is sustained for several days and is usually preceded by a slight fall in temperature. If intercourse occurs near the time of the temperature shift there will be a better chance of conception than if intercourse occurs only at other times in the cycle. The span during which the ovum is susceptible to fertilization is believed to be from 12 to 24 hours. The author states that the length of pregnancy is 266 days rather than the accepted 280 days.

The reason for the temperature shift is not established. Two suggestions are offered: (1) that progesterone elevates the temperature, and (2) that during the preovulatory phase the temperature is depressed by estrogens.

The basal body temperature graphs can be used for the following: (1) to determine the time of maximum and minimum fertility, (2) to determine the time for artificial insemination and endometrial biopsies, (3) to aid in securing early human ova, (4) to help in evaluating the effectiveness of treatment designed to produce ovulation, especially x-ray therapy, and (5) in occasional cases, to predict the date of delivery. CATHERINE B. HESS, M.D.

GENITOURINARY SURGERY

ADRENAL, KIDNEY, AND URETER

Peters, J. T.: Origin and Development of a New Therapy for Crush Injury, Transfusion Kidney, and a Certain Number of Other Diseases. *Acta med. scand.*, 1945, 123: 90.

Considering the fact that a part of the kidney function is a mechanical filtration process, the author constructed an artificial "nephron" of glass and rubber. By means of this apparatus, it could easily be demonstrated that not only oliguria and anuria, but also polyuria could be imitated by a purely mechanical device. The imitation anuria was produced, without any obstruction, as a result of increased intrarenal pressure, which caused a decrease of the effective filtration pressure.

The presence of an increased intrarenal pressure in vivo is readily deduced from certain pathological findings. Thus, the obstruction of the tubules by blood clots, cell detritus, and crystals is often found, at autopsy, to be present only in a small part of the kidney, or it is altogether absent. An obstruction, therefore, is unnecessary for the development of anuria.

In mercury poisoning, crush injury, transfusion kidney, and several other diseases, oliguria or anuria associated with hyperazotemia and uremia is the important syndrome. For the treatment of these conditions, decapsulation of the kidney is recommended, on the assumption that the condition is the result of increased intrarenal pressure. This should be considered an emergency operation, and should be done on the first day that the syndrome develops.

Uremia caused by glomerular destruction, however, must be sharply differentiated from the uremia caused by increased intrarenal pressure. The former cannot be cured by lowering the intrarenal pressure by a few millimeters of mercury. In the latter, decapsulation, diuretics, and pressor drugs are now widely used, either separately or in combination, and apparently with success. SAMUEL KAHN, M.D.

Abramson, D. J.: Renal Typhoid Fever; Presentation of a Case of the Primary Type. *J. Urol.*, Balt., 1945, 54: 422.

A case of primary renal typhoid is presented. It is of additional interest because of the presence of calculi and pyelonephrosis. Enteric typhoid had been consistently excluded by negative clinical findings, Widal tests, and stool and blood cultures.

Emphasis is placed on the necessity of careful bacteriological examinations of routine urinary cultures, the lack of significance of Widal tests in previously immunized individuals, and the value of conservative treatment. The role of sulfonamides in renal typhoid deserves further study.

Both primary and secondary renal typhoid are discussed. The epidemiological significance of typhoid disease of the kidney and of the carrier state is emphasized. JOHN A. LOEF, M.D.

Jacobs, A.: Tuberculous Disease of the Kidney. *Glasgow M. J.*, 1945, 144: 161.

The author presents a set of concepts for dealing with tuberculous disease of the kidney, based on a series of over 250 nephrectomies and a further untotaled series of unoperated cases of renal tuberculosis. He divides the disease into three main clinical groups: tubercle bacilluria without urinary symptoms, renal involvement with signs and symptoms confined solely to the urinary tract and no other obvious tuberculous focus, and renal involvement appearing subsequent to the occurrence of an extrarenal lesion.

Tubercle bacilluria, according to the author, requires only follow-up urological examination. In many cases, the minute renal lesions accounting for the bacilluria will heal; in others, the microscopic foci will progress and the second clinical condition will develop, that of obvious renal involvement. In unilateral disease nephrectomy is indicated. In bilateral involvement the operation is contraindicated, unless the involvement on one side is minimal and it is believed that removal of the badly infected kidney will materially improve the patient's general condition. In cases of renal tuberculosis complicated by extrarenal foci, the more serious life taking lesions are granted precedence in the institution of treatment.

Intractable tuberculous cystitis, which has failed to show improvement over a reasonable period of time following nephrectomy, will require diversion of the urinary stream by nephrostomy, cutaneous ureterostomy, or transplantation of the ureter into the bowel. CLARENCE V. HODGES, M.D.

Ladewig, P., and Eser, S.: Malignant Tubular Adenoma in a Horseshoe Kidney; Its Significance with Regard to General Cancer Pathology. *J. Path. Bact.*, Lond., 1945, 57: 405.

A case of malignant tubular adenoma arising within a horseshoe kidney is described by the authors and discussed with regard to its bearing on general cancer pathology. It is concluded (1) that the tubular adenoma ought to be regarded as a cancer matrix according to Cohnheim's theory of displaced embryonic tissue; (2) that such displaced embryonic tissues as well as hyper-regenerative, hormonal and other tissue disturbances merely provide zones of potential growth instability; (3) that in these zones "irritation" in the widest conception of the term may induce the fatal event of the cancer cell's birth as a somatic mutation; and (4) that Cohnheim's theory and the "irritation" theory of cancer are not mutually exclusive, but complementary.

The most widely accepted view is to regard the tubular adenoma as the result of an abnormality in fetal development at the time when the ureteric bud joins up with the metanephrogenic blastema and induces its differentiation and growth. In this stage, certain elements of the tissues involved may fail to establish contact and become excluded from the co-ordination of further development. They are left free to unfold their remaining growth potency in unusual ways. This theory finds support in the authors' case from the peculiar combination of adenoma and horseshoe kidney. It is, in fact, generally agreed that horseshoe kidney is due to unusual growth impulses of the metanephrogenic tissues whereby the bilateral blastemas come into collision. In view of this, the authors believe that they can accept the dysontogenetic nature of the tubular adenoma.

The tubular adenoma with its dysontogenetic origin is only a peculiar ground on which the malignant change has taken place. In the same way adenoma of the cirrhotic liver predisposes to malignancy, as do adenoma of the prostate, certain forms of adenoma of the female breast, and, in rare instances, adenoma of the thyroid gland. The cause of the formation of these different adenomas is the potentiality for prospective growth in existent embryonic tissue, hyper-regenerative power in impaired tissue, or even unbalanced hormonal stimulation. But none of these can be regarded, by themselves, as responsible for the induction of malignancy. This is shown by the uneven ratio between the frequent occurrence of adenomas and the relatively rare incidence of their malignant transformation. Moreover, in accordance with recent research on the subject, we are justified in assuming that spontaneous cancer development is the result of an incidental and peculiar combination of various factors and influences, no one of which necessarily bears directly and specifically on the final result. JOSEPH K. NARAT, M.D.

Bowie, C. F., and Bors, E.: Primary Carcinoma of the Ureter. *J. Urol.*, Balt., 1945, 54: 434.

Primary carcinoma of the ureter can still be considered a rare tumor, although an increasing number of cases have been reported during the past decade. The total number of reported cases up to date is 175.

A case of carcinoma of the ureter, complicated by severe infection which made the diagnosis more difficult, is reported. The operative technique is reported in detail because certain well recognized general surgical principles used in attacking malignant tumors anywhere else in the body were employed. No priority is claimed on the technique.

The principles carried out in this case were (1) opening of the peritoneal cavity for evidence of spread of the tumor, (2) beginning dissection in healthy tissue above the tumor, and (3) after the tumor was reached from above, dissection on the bladder side with the electrosurgical knife, the whole tumor being removed en masse. The kidney and remaining portion of the ureter were removed 4 months later. No evidence of tumor was present. Cystoscopy revealed a normal bladder with no evidence of recurrence.

JOHN E. KIRKPATRICK, M.D.

BLADDER, URETHRA, AND PENIS

Krafka, J., Jr.: The Elasticity of the Human Urinary Bladder. *J. Urol.*, Balt., 1945, 54: 438.

Incidental to studies made on the elasticity of the human aorta, tests were run on the elongation of standard strips of urinary bladder. The technique used was that previously described, in which increasing weights, applied by the gravity pull on a carriage running on an inclined plane, exert a stretching force on the specimen and automatically record the relationships. The machine used was the Scott serigraph, which is commonly employed in fabric laboratories for measuring the elasticity and the tensile strength of thread.

It is common textbook knowledge that the detrusor serves as the principal agent in the emptying of the bladder. The urologists are also aware of the character of the pressure curves developed during the filling of the bladder. The commonly accepted value for emptying of the bladder is between 20 and 40 mm.Hg, upon which is superimposed an additional volitional pressure produced by contractions of the abdominal muscles and the descent of the diaphragm which brings the total intravesicular pressure to approximately 74 mm. It is also observed that the pressure developed upon the addition of successive increments of fluid to the bladder volume is initially high, but immediately levels off to fixed values proportional to the volumes prevailing. These reactions are commonly interpreted as due to balance in muscle tonus, and the primary and secondary pressures are used as indications of hypertonicity or atony in various pathological states.

That such pressures prevail at other sites in the body has been well established. Hamilton, Woodbury, and Harper (1936) have made a study of cough and strain upon the blood pressure and upon the cerebrospinal fluid. Intracranial pressure may be raised 50 mm. Hg, and there is one record of a blood pressure of 380 mm., due to strain.

Woodbury, Hamilton, and Torpin (1937), in an analysis of intrauterine pressure, have shown that 70 mm. pressure can be transmitted to the intragastric pressure and a like equivalent to the pregnant uterus.

Muschat (1935) noted a maximum of 60 mm. Hg pressure in the bladder of the tabetic with a paralyzed bladder wall, but an intact abdomen.

Another concept, of course, would need to be considered in a corollary to the one just developed; namely, the protection of the ureters against these high intravesicular pressures. Wuellenweber has made a study of the pressure prevailing in the kidney pelvis at various intravesicular pressures. The for-

mer is always lower than the latter. Thus at 120 mm. bladder pressure the pelvic pressure is 70 mm. (water); at 350, it is 200 mm. This factor, however, is not so significant as the main one since the angulation of the ureter and the muscles of Waldeyer seem to provide a competent mechanism to prevent transmissal of the high pressures to the ureter.

That the musculature of the bladder does maintain a definite tonus is seen in the work of Holmes (1933) on the paralyzed bladder. Injury to the cervical, dorsal, or sacral cord results in an atonic bladder with a characteristic volume pressure relation on filling. His figure 2 shows a definite filling-emptying curve which are reciprocals. His figure 7 shows one of the features noted by Langworthy, namely, a sharp straight line rise followed by a rapid return to a base line in the course of a few minutes.

The effective stimulus to the emptying of the bladder is commonly assumed to be tension in the bladder wall. Free nerve endings and pressure corpuscles have been described, but it is difficult to see how these can in one instance give the sensation of fullness, then urgency and lastly pain. If the simple assumption is made that the tonus of the muscle develops and mediates the sensation, a reasonable opinion is at hand. Hypertonic bladders empty at small volumes; atonic bladders store tremendous volumes of urine, either under pathological states or in the last months of pregnancy. Irregular contractures are seen normally at 400 c.c. volume, and spontaneous contractures are noted after the steep parts of the cystometrogram curve. Curves are materially affected in the case of megacolon. How these factors could be applied to simple nerve endings or to pressure corpuscles is not clear, but they would all be effective in muscle tone. Smooth muscle must act as a sensory ending to mediate its own reflexes either local or central.

The percentage stretch of standard strips of urinary bladder have been measured, and Young's modulus calculated. The values range from 0.488 to 4.840 dynes per centimeter square x 10^6.

The elasticity curves for the bladder have been compared to those for the aorta. The character of the curves is essentially different; that for the aorta is a geometric curve, for the bladder a straight line curve. Within the limits of the test, the distensibility of the bladder is not checked by collagenous fibers such as are seen in the aorta.

Calculations are presented which equilibrate the stretching forces against manometric pressures, as noted in the bladder by other investigators using the cystometer.

The theory of muscle function in the bladder is discussed. The primary function of bladder emptying for the detrusor is accepted. Secondary functions are 3 in number. The first of these is to provide an elastic membrane which can adjust bladder volume to bladder pressure. The second function is to provide a local elastic mechanism to adjust for the accessory pressures impressed on the bladder by cough and strain. The third considers the muscle as a sensory organ for the mediation of the stress sense as a stimulus to voiding.

JOHN E. KIRKPATRICK, M.D.

GENITAL ORGANS

Heyman, A., Beeson, P. B., and Sheldon, W. H.: The Diagnosis of Chancroid. *J. Am. M. Ass.*, 1945, 129: 935.

The methods employed at present for the diagnosis of chancroid are far from satisfactory. Current textbooks indicate that accurate diagnosis can be based on the clinical features, on the results of skin tests, or on the examination of stained smears. Most venereologists, however, know that each of these methods is subject to major limitations and errors. Actually, at present the diagnosis is usually based on negative dark field examinations for spirochetes, and on clinical improvement after the institution of sulfonamide therapy. The establishment of reliable criteria for a positive diagnosis of chancroid would unquestionably be of value.

The present article is a report on the relative efficiency and usefulness of a number of diagnostic procedures in chancroid. These findings were obtained during an intensive study of a group of 125 patients suspected of having either chancroid or lymphogranuloma venereum.

A positive diagnosis of chancroid was made in 60 of them. Of the various methods, biopsy appears to be the most efficient single method of diagnosis and can be depended on to give a diagnosis in over 90 per cent of the cases in which it is applicable. Its use is limited to cases in which there are primary genital lesions. The removal of tissue for biopsy is in most instances a simple procedure, well suited to outpatient work. It is undesirable, however, in patients with small lesions because of the pain involved.

Cultural demonstration of the Ducrey bacillus can be accomplished in at least 75 per cent of all cases. The technique is not difficult and can be carried out by a competent technician. Culture is less likely to be successful in advanced lesions which are heavily contaminated with other bacteria. It is the only means of obtaining a positive diagnosis in patients with buboes but without primary lesions.

Diagnosis by means of direct smears of genital lesions is possible in approximately 50 per cent of the cases. This method has the advantage of simplicity and immediate diagnosis. Unfortunately, it is likely to be useless in advanced lesions, in which there is a heavy growth of other bacteria.

Autoinoculation has several disadvantages and does not take with sufficient frequency to make it of value in routine work.

The skin test for chancroid should never be relied on as the sole method of diagnosis, although it may be of limited value as an adjuvant to other procedures. In this group of 60 proved cases of chancroid, positive skin tests were found in only 46 (77 per cent). A further disadvantage lies in the fact that a positive skin reaction persists for many years after

an infection and therefore may not be significant in reference to the present illness.

The diagnosis of chancroid can in the majority of cases be established by suitable laboratory procedures. JOHN E. KIRKPATRICK, M.D.

Lazarus, J. A.: The Significance of Spontaneous Hematuria Associated with Hypertrophy of the Prostate. *J. Urol.*, Balt., 1945, 54: 531.

Spontaneous hematuria is not infrequently an outstanding symptom among patients with prostatism, and in certain instances it may be the chief complaint. The hematuria may vary from the presence of a few erythrocytes to the high power field (occult blood) to massive bleeding, which may at times assume alarming proportions. It may be due to the prostate itself or to conditions which are extrinsic to the prostate, such as a cystitis secondary to and aggravated by urinary retention; vesical, renal, and ureteral calculi; tumors of the bladder or in vesical diverticula; tumors of the kidney; hydronephrosis; and acute or chronic glomerulonephritis.

Since the hematuria is due so commonly to the prostate itself, the urologist is frequently too casual in his examination after establishing the presence of a prostatic hypertrophy. If he then proceeds to perform a prostatectomy under the mistaken notion that the bleeding is due to the prostate, when in reality it is due to a coexisting renal tumor or some other condition which is unrelated to the prostate, the outcome may be disastrous.

The author is, therefore, of the opinion that a complete urological study is indicated in every case of prostatic hypertrophy with hematuria.

Although many urologists have established an aversion for one reason or another to performing cystoscopic examinations upon their prostatic patients, the author believes that cystoscopy should be carried out in these cases whenever it is technically possible. He believes that the cystogram and other indirect methods give inadequate information. In addition to providing direct visualization of the vesical neck and lumen, cystoscopy gives the opportunity to catheterize the ureters and to take retrograde pyelograms in the event that no obvious cause for the bleeding can be found in the bladder or in the prostatic urethra.

FREDERICK LIEBERTHAL, M.D

Ferguson, J. D., and Pagel, W.: Some Observations on Carcinoma of the Prostate Treated with Estrogens, as Demonstrated by Serial Biopsies. *Brit. J. Surg.*, 1945, 33: 122.

The authors carried out repeated biopsies by transurethral resection in a small number of patients with carcinoma of the prostate who had received estrogens for from 6 to 30 months. They distinguish two types of tumors: those which arise in atrophic tissue in the posterior lobe of an otherwise normal gland, and those which develop secondarily in a gland presenting benign hypertrophy. The latter are usually latent and are discovered during routine microscopy of the enucleated gland. The former are more common, and have usually extended by the time the diagnosis is made. All of the material studied was composed of this type.

The authors took a careful history, studied the urine for infection, tested renal function, and repeatedly estimated the serum acid phosphatase. Anteroposterior views of the lumbar spine, pelvis, and upper ends of the femurs were taken before and after treatment. Occasionally, intravenous urograms were made. Four of the 5 cases were treated with stilbestrol and 1 was treated with dienestrol. The Gershom Thompson cold punch was used, and biopsy specimens were taken from the posterior quadrant of the prostatic urethra immediately above the verumontanum. Coagulation hemostasis was used as infrequently as possible.

The studies showed that in addition to an apparent reduction in the number of tumor units in the later sections, there were cellular changes such as a diminution in the size of the nuclei, measured quantitatively. There was a regressive change from a more cellular type of growth to a scirrhous form. In later sections there was again a diminution in the size of the cell nuclei with concentration of chromatin, pyknosis, and vacuolation of the cells.

DAVID ROSENBLOOM, M.D.

Muschat, M.: Osteitis Pubis following Prostatectomy. *J. Urol.*, Balt., 1945, 54: 447.

The condition described is rather unusual. It was first presented as an entity by Beer in 1924. Since then an occasional report is found under the title of periostitis, osteitis pubis, or osteochondritis, depending on which tissue seems predominately affected. Osteitis pubis appears as a distinct disease entity with a more or less characteristic course, having no resemblance to an ordinary pyogenic or tuberculous osteomyelitis. It occurs in a small number of patients following operations upon the urinary bladder, especially after prostatectomy. It is an inflammatory process of the bone, which begins in the symphysis pubis and gradually involves the pubic rami all the way down to one or both ischii. This inflammatory process spreads via the periosteum to the variously attached muscles of the pelvis, especially the obturator internus and levator ani, keeping them in a spastic state. Aschner describes the characteristic clinical picture most graphically: "The pain is intense and disabling in its effects. It forces the sufferer to lie down and when down he cannot get up, nor turn from side to side, except in fear and agony."

The etiology of this condition is obscure: the clinical picture with its symptomatology, however, is clear and follows a definite pattern. This pattern is practically identical in every case, from the onset of the disease until clinical cure ensures, the patient going through a period of physical agony lasting from 3 to 12 months. Two cases of osteitis pubis are described in detail, and a summary of the few cases

from the literature, with a discussion of the etiology, symptomatology, clinical findings, x-ray studies, pathology, therapy, and prognosis, is also included.

As in every other disease in which the sufferings of the patient are very great and prolonged, various therapeutic agents were tried. The most frequently used therapy was diathermy, baking, and massage. None of these therapeutic procedures helped in the slightest. Most patients claimed that the diathermy aggravated their pain. X-ray therapy was found useless. Application of a body cast is always suggested by the orthopedic surgeon who believes, and rightly so, that immobilization of the pelvis by a solid body cast will relieve the agony of pain. The patients, however, are very intolerant to a body cast.

It is the author's conviction that the disease is self-limited and that surgical intervention is not required, but if an abscess does develop it should of course be properly drained. Penicillin (4,000,000 units) was used in case 2 without any subjective improvement whatsoever, but it may have caused the absorption of the inflammatory lumps near the ischii. Sulfa drugs were tried without influencing the condition one iota. Any manipulative procedure to hasten the recovery is strongly contraindicated; it only aggravates the condition and stirs up local trauma, thus actually spreading the disease process and delaying the recovery. In a case reported by Barnes, the patient submitted to the "adjustments" of a chiropractor for several months. The "adjustments" were usually followed by chills and temperature as high as 105, and the patient was told that these reactions were supposed to be very beneficial. The majority of patients become so apprehensive that before long one gets the impression that they are greatly exaggerating their pain. The physician, therefore, is frequently tempted to force early activity and to encourage the patient to get out of bed and move about. The author found such forceful actions detrimental to ultimate recovery, which was retarded for many weeks. He states that "whenever such activity is contemplated, another x-ray study will usually disclose that instead of improvement the process is at its worst and absolute rest is indicated."

Prognosis. The ultimate outcome in all cases is good. There is no spread of the disease to other structures or organs. The only complication is an occasional abscess formation with restitution after drainage. The only demonstrable scar is the complete ossification and ankylosis of the symphysis. This, fortunately, remains symptomless and the patient resumes his normal life.

JOHN E. KIRKPATRICK, M.D.

Bishop, P. M. F.: Studies in Clinical Endocrinology. The Management of the Undescended Testicle. *Guy's Hosp. Rep.*, Lond., 1945, 94: 12.

The author emphasizes the importance of close co-operation between the endocrinologist and the surgeon in deciding which form or combination of forms of treatment of undescended testicle will be most effective, and states that the decision should be based upon the individual situation present in each case. In his terminology, the word "testicle" is used in its literal sense, i.e., a little testis. He describes the mechanism of normal testicular descent as occurring in three stages—abdominal, canalicular, and extracanalicular—and extensively reviews the literature to discuss the various causes that have been postulated to account for incomplete descent. These are: fetal peritonitis, defective development of the transversalis fascia, intercolumnar fascia, cremasteric fascia or muscle, shortening of the cremaster muscle because of too powerful contraction, shortening of the processus vaginalis or of the cord structures, absence of the external ring and absence of the entire inguinal canal, including both internal and external rings. Maldescent is often found to be associated with other physical and mental congenital deformities. The incidence of various positions of arrest, as described by various observers, is discussed.

Apart from the mechanical factors incident to body growth that play a role in the normal descent of the testicle, chorionic gonadotropin is a responsible endocrine factor. It causes enlargement of the testicle (indirectly a mechanical factor), stimulates the development of all the connective tissue elements associated with the testicle in its descent, and therefore elongates the cord structures, and, by its action on the interstitial tissue of the testicle, stimulates the secretion of androgen which "secondarily causes full development of the sexual apparatus, thus assisting the descent of the testicle" (Molien, d'Armour, and Gustavson, quoted by the author).

A portion of the author's cases support the somewhat controversial view that androgenesis is affected by maldescent; the author is in full agreement with other writers that spermatogenesis is profoundly affected. He also believes that chorionic gonadotropin, although it may stimulate androgenesis, has no effect on spermatogenesis.

The evidence, both direct and indirect, for spontaneous descent of the testicle after birth is reviewed with the conclusion that it does occur.

Complications and sequelae incident to undescended testicle are: pain, vulnerability to trauma, infection, hydrocele, torsion psychological effects, and malignant degeneration. However, endocrine or surgical procedures for inducing descent do not seem to diminish the possibility of malignancy.

From a surgical point of view, cases may be classified into three groups:

Surgery of the atrophied testicle, i.e., removal to prevent possible malignant changes, orchidopexy for cosmetic and psychological reasons, or either procedure to avoid the liability of trauma or torsion.

Surgery of the testicle with a deviated or impeded descent, in which the problem is purely a mechanical one and consists merely of obviating the difficulty caused by fibrous bands, adhesions, or hernial involvement. The best surgical results are obtained in

this group, subject to the author's arbitrary qualification that the patient should not be older than 10 or 11 years.

Surgery of the testicle with a delayed descent, which is rendered difficult by the problem of preserving the blood supply of the testis.

The optimal age for endocrine therapy must be determined because (1) overdosage at an early age may lead to premature puberty; (2) the tissues are more responsive at the time of puberty; and (3) the longer a testicle is left undescended after spermatogenesis begins, the greater the danger of irreparable damage, first to the seminiferous tubules and later to the interstitial tissues. The criterion for dosage is the tendency toward excessive androgenic development. Most authors cited believe that endocrine therapy should not be continued for more than a few months. Abdominal testicles are not likely to respond to endocrine therapy, canalicular testicles are more responsive in a high percentage of cases (60 per cent in the cases cited by the author), and extracanalicular testicles are difficult to evaluate and are therefore excluded from the author's analysis. Adverse effects of endocrine therapy, employed in proper dosage, were not noted by the author.

The conclusions derived from this study are: (1) the extracanalicular testicle is a surgical problem; (2) the canalicular testicle is primarily an endocrine problem and should be treated surgically only after endocrine therapy has failed or when there is a complicating mechanical impedance; and (3) the abdominal testicle is unlikely to respond to either method of treatment. CLARENCE V. HODGES, M.D.

Vermeulen, C. W., and Hagerty, C. S.: Torsion of the Appendix Testis (Hydatid of Morgagni); Report of 2 Cases with a Study of the Microscopic Anatomy. *J. Urol.*, Balt., 1945, 54: 459.

The observation of 2 cases of torsion of the appendix testis by one of the authors in a limited and brief urological experience led the authors of this article to believe that the condition is perhaps more common than reports would indicate. Unless it is realized that the severity of the symptoms produced by torsion of this minute structure may be out of all proportion to the size of the appendix testis, the condition may easily be mistaken for other intrascrotal diseases, such as acute epididymitis, acute orchitis, or torsion of the spermatic cord. In other instances a diagnostic mistake may be made because the initial symptoms sometimes focus attention upon the lower abdomen, with little to indicate that the lesion is inside of the scrotum. This occurred in the first case described in this article in which the nonscrotal symptoms and signs confused the diagnosis to the extent that the condition was first called acute appendicitis.

Diagnosis of torsion of the appendix testis may be very difficult. In general, the symptomatology is that of torsion of the testis. Both conditions occur chiefly in preadolescent or young adult males. In both, attacks of incomplete transient torsion with slight symptoms may have occurred previous to the acute severe episode. It has been said that torsion of the appendix testis does not result in inflammation of the scrotal skin, while torsion of the testis does produce this condition. However, in both of the authors' cases, marked erythema and edema of the skin of the affected side occurred.

Except by palpation of the spermatic cord and the scrotal contents, it will be impossible to distinguish between torsion of the testis and torsion of the appendix testis. If there is a tender mass anterior to the testis, it may be either the epididymis of a rotated testis or a twisted appendix testis. Differentiation can be made only by careful examination.

The epididymis of a rotated testis would extend down the entire length of the testis, while an anterior mass due to torsion of the appendix testis would be limited to its upper pole and be movable upon the testis.

Very little information could be obtained from articles on torsion of the appendix testis regarding the usual histological appearance of this small structure. Furthermore, textbooks on histology give descriptions that are not entirely in accord. For example, Bailey's "Textbook of Histology" states that "the appendix testis (hydatid of Morgagni) is a vesicular structure lined by simple columnar epithelium surrounded by vascular connective tissue." Maximow and Bloom say that the appendix testis is "a small nodule consisting of vascular connective tissue and lined with columnar, sometimes ciliated epithelium." Lowsley and Kirwin state that the "hydatid of Morgagni is a pedunculated, pear-shaped sac, from one-eighth to one-third inch long, its free extremity dilated and containing a colorless fluid." The lack of information on the histological structure in case reports of torsion of the appendix testis and conflicting reports on the histological picture as described in textbooks, prompted the study of 28 appendices testes from the standpoint of their gross and microscopic anatomy.

Grossly, the appendix testis is a small ovoid or flattened tab of pale gelatinous tissue varying from 1 mm. to 1.0 cm. in diameter. It is attached to the tunica albuginea by a short pedicle. In at least half of the specimens examined, the pedicle was sufficiently long and narrow so that it could have undergone torsion.

Microscopically the appendix testis was made up of loosely arranged connective tissue which was moderately rich in blood vessels. In the connective tissue of some specimens were seen spaces of varying size apparently lined with endothelium and frequently containing a precipitated albuminous material. These structures had more the appearance of lymph channels than that of remnants of epithelial lined tubules. Most of the specimens had a few scattered leucocytes in the tissues. All of the appendices testes were covered by tall columnar epithelium which was sometimes ciliated, and associated with the columnar epithelium were a few

round, pale, mucous secreting cells. This epithelium became continuous with the very flat columnar epithelium of the tunica albuginea.

Epithelial inclusions were present in 2 of the 28 specimens. The epithelial covering of the appendix testis and the lining of the epithelial inclusions closely resembled the lining of the distal end of the fallopian tube of the female. This would be expected because the appendix testis is derived from the cranial end of the muellerian duct, which in the female forms the fimbriated end of the fallopian tube. JOHN E. KIRKPATRICK, M.D.

Francis, R. S.: The Status of Hormonal Bioassay in Malignant Disease of the Testicle. *Brit. J. Surg.*, 1945, 33: 173.

With the exception of the seminoma, which is considered to be derived from the spermatic tubule cells, testicular tumors have come to be denoted by the name "teratoma," and other names, depending upon the type of tissue which predominates, have been applied to this group, such as chorioepithelioma, embryonal adenocarcinoma, "teratoid carcinoma with cancerous elements," and "mixed adult types with carcinoma."

In 1930 Zondek discovered that malignant tumors of the testis caused the urine to give a positive Ascheim-Zondek pregnancy test. In the test animal's ovary, three results were obtained: (1) ripening of the graafian follicle; (2) hemorrhage into the cyst; and (3) gross enlargement of the uterine horns. It is now understood that the hormone output tends to vary indirectly with the degree of cellular maturity of the tumor. However, one cannot foretell the histological type of tumor from bioassay of the tumor alone. There is a correlation between the hormone levels and the clinical course, and consistent high levels usually lead to a fatal outcome. It must be pointed out that many negative assays have been associated with malignancy.

The test is a valuable indication of the effectiveness of treatment. When the hormone output falls to 400 mouse units per liter within two weeks of the completion of treatment, the prognosis is good. A rising or stationary titer after treatment is a bad omen; it is due to local recurrence or metastasis.

The test has various limitations, such as variations of methods of extracting urine, the numbers of mice used per level of assay, variations in the interpretation of ovary changes, and the original masses of tissue present which give rise to increased hormone output. In the present stage of the test, the assay of the urinary hormones is not a basis for attempting to foretell the histological type of tumor. There is some evidence that the seminomas produce only follicle stimulating hormone and that embryonal teratomas produce both follicle and lutein stimulating hormone (chorionic hormone). Simple orchectomy is the operation of choice, followed routinely by irradiation, especially of the aortic glands, whether or not metastases are suspected. This routine would cause fibrosis of the lymph-drainage system, and prevent the spread of a possible local recurrence subsequent to treatment.

There is need for a standardized technique of extracting hormones, taking 24 hour specimens, making routine assays before treatment and serially during and after treatment, using more than 1 mouse per level of concentration, making histological section of the mouse ovary after the test, and making bioassay of the tumor with determination of the two hormones separately. While the range of titer is characteristic for the three main groups—the embryonal teratoma, the seminoma, and the mixed adult teratoma—the precise pathology of a particular tumor cannot be predicted from the preoperative urinary assay, although low levels suggest either seminoma or the mixed adult type. Follow-up tests should be performed for at least 10 years after treatment—first weekly, then at less frequent intervals, and then at six month periods.

DAVID ROSENBLOOM, M.D.

MISCELLANEOUS

Burhans, R. A.: Treatment of Orchitis of Mumps. *J. Urol.*, Balt., 1945, 54: 547.

The so-called entity "orchitis of mumps" is a misnomer. It has been considered an infection or inflammation involving the testes. In a naval hospital, it was observed that the patients do not develop primarily an orchitis of mumps, but an acute hydrocele around the testicle which causes a strangulation of the testicle, in contradistinction to a slow forming hydrocele. This acute process causes strangulation, acute inflammatory edema, and ultimate fibrosis and atrophy of the testes. These facts have been substantiated at operation.

During the acute scrotal involvement of mumps there is a high fever and leucocytosis, but after from 12 to 24 hours the damage has been done even though the temperature subsides.

If a small scrotal incision is made during the acute orchitis, an acute hydrocele is encountered, in which the fluid in the tunica vaginalis is under extreme pressure and has a viscid yellowish color. After drainage, no other treatment is necessary and the fever simulates a crisis of pneumonia. If drainage is delayed, the tension in the hydrocele lessens, the testicle becomes blackish, and the testicular tissue presents bulbous edema and inflammation.

In early cases of "orchitis of mumps" incision of the acute hydrocele with removal of the drain in 48 hours is indicated, and in late cases, the tunica propria and albuginia should also be drained. Pentothal sodium anesthesia has proved most satisfactory, but local anesthesia has not, as the involved area is tender. DAVID ROSENBLOOM, M.D.

Cook, E. N., and Keating, F. R. Jr.: Renal Calculi Associated with Hyperparathyroidism. *J. Urol.*, Balt., 1945, 54: 525.

Since only 14 cases of proved hyperparathyroidism were observed at the Mayo Clinic from 1929 to

1943, and since this incidence was at a variance with the experience of Albright and his associates who accumulated 67 cases in 10 years, the authors made a deliberate search for the disease in the material of the Mayo Clinic from January, 1943 to July, 1944. They discovered 18 cases. In 4 of these the patients had only the classical disease of the bone which is observed in hyperparathyroidism, while in 14, associated renal calculi were demonstrated and evidence of disease of the bone was minimal or absent.

During this same period, 850 cases of urinary calculus were seen. Although this would indicate an incidence of 2 per cent of hyperparathyroidism in cases of urinary calculus, the authors believe that this figure is far too low since only a relatively small proportion of these patients were subjected to a sufficiently careful metabolic study to exclude hyperparathyroidism completely.

A hyperfunctioning parathyroid adenoma was demonstrated in all of the 18 cases of hyperparathyroidism.

The frequency with which the diagnosis is made correctly will vary directly in proportion to the thoroughness with which a search is made for the disease. The greatest opportunity for establishing such a diagnosis will appear in cases of multiple or recurrent calculi. Approximately 10 per cent of urinary calculi will recur following surgical removal. The authors believe that this percentage can be reduced appreciably if the presence of hyperparathyroidism is carefully excluded.

The diagnostic criteria of hyperparathyroidism are hypercalcemia, hypophosphatemia, hypercalcinuria, and hyperphosphaturia. Frequently repeated examinations are often necessary to establish a diagnosis. Roentgenological findings may be helpful in cases with associated disease of the bone. In cases in which there is uncertainty the authors frequently rely upon quantitative determinations of the calcium in the urine while the patient is on a diet low in calcium.

When calculi are present the symptoms are identical with those occurring with calculi due to other causes. In all such cases a detailed urological study is indicated. It is usually advisable to remedy the hyperparathyroidism first, as subsequent calculi may develop rapidly. It may, however, be necessary to take care of the urological problem first because of its acute character.

Many forms of medical therapy have been tried. Diets low in calcium are unlikely to alleviate the renal symptoms and subject the skeleton to the hazard of demineralization. Diets high in calcium increase the tendency toward stone formation. Acidifying drugs such as ammonium chloride are of little avail because the increased solubility of calcium in an acid urine is counteracted by a resulting increased output of calcium in the urine.

The treatment of hyperparathyroidism is surgical, by removal of the offending parathyroid adenoma, or when primary hypertrophy of all parathyroid tissue is involved, by subtotal resection of the parathyroid glands. The urinary calculi already present usually remain unchanged, but in a few instances they have eventually dissolved.

FREDERICK LIEBERTHAL, M.D.

Hellendall, H.: Experimental Transmission of Lymphogranuloma Venereum Virus through the Placenta. *Am. J. Surg.*, 1945, 70: 320.

Since it is known that the virus of lymphogranuloma venereum can invade the blood stream, the author attempted to determine if lymphogranuloma venereum can be transmitted through the placenta to the fetus. In 1936 a positive Frei reaction in a 14 day old infant was observed by Dick. The author's studies in 1942 showed that the antigen prepared from the fetal brains of mice gave positive intradermal reactions.

The present work was concerned with three questions: (1) Can the previous work with mice be confirmed with Frei tests in human beings? (2) Can the initial elementary bodies of the lymphogranuloma virus be found in smears and tissues of the fetal brain? and (3) Will antigens from the brain of an intracerebrally infected mouse give a positive Frei test when injected into the skin of an apparently healthy offspring of an infected mother?

The conclusion was reached that lymphogranuloma virus is transmitted through the placenta to the newborn before delivery. The clinical question as to whether there is any occurrence of congenital lymphogranulomatosis in human beings should be studied with a great amount of statistical material.

DAVID ROSENBLOOM, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Meyerding, H. W.: Chronic Sclerosing Osteitis. *West. J. Surg.*, 1945, 53: 413.

The patients included in this series of 80 cases of chronic sclerosing osteitis were of the average age of 25 years, appeared to be in good health, and were not disabled. The preoperative clinical laboratory findings of the blood and urine were of little value in the diagnosis. Trauma may have been an inciting factor of the condition in 31.2 per cent of the cases.

The outstanding symptom was persistent localized pain in 93.8 per cent of the cases; in 67.5 per cent this was associated with swelling. The duration of the symptoms averaged 1.4 years. Sixty-five per cent of the patients were males. In 92.5 per cent of the cases the lesions were located in the lower extremity; 50 per cent occurred in the middle third of the shaft of a long bone; 90 per cent occurred in the shaft of the tibia or femur. Patients aged from 10 to 30 years comprised 69 per cent of the total number.

The roentgenograms revealed dense spindle shaped cortical regions of sclerosis that involved the shaft of the long bones. Translucent regions, small and round, or oval, were often visible. These regions sometimes showed staphylococci on bacteriological examination of the material removed at operation and have been looked on as foci of infection producing the sclerosis.

The treatment is surgical excision, and the results obtained are good.

Compere, E. L., Schnute, W. J., and Cattell, L. M.: The Use of Penicillin in the Treatment of Acute Hematogenous Osteomyelitis in Children. *Ann. Surg.*, 1945, 122: 954.

This is a report of 12 consecutive cases of acute hematogenous osteomyelitis in children ranging from 3 to 12 years of age which were treated with penicillin.

Ten of the cases had been resistant to sulfonamides and only 4 required surgery. There were no deaths.

The authors state that penicillin appears to be more effective in the treatment of acute hematogenous osteomyelitis than any other therapeutic agent including the sulfonamides.

Adequate doses of penicillin, from 15,000 to 20,000 units, administered every 3 hours day and night, may not only cure the initial infection but prevent spread to other bones, and in most of the cases they make surgery unnecessary. If the treatment is started late, bone damage may call for late surgery.

Medical care must not be neglected in these cases. The fluid balance of the body must be maintained with normal saline solution, glucose, blood, or plasma. Splints, plaster casts, or traction are used when indicated. DANIEL H. LEVINTHAL, M.D.

Maróttoli, O. R.: Osteoarticular Lesions in Brucellosis (Lesiones osteoarticulares de la brucelosis). *Rev. méd. Rosario*, 1945, 35: 821.

Osteoarticular lesions observed in the course of evolution of brucellosis are characterized, as is the disease itself, by clinical manifestations of various forms. There are many transitional forms between monoarticular and generalized, polyarticular lesions. From the physiopathological viewpoint the syndrome may be divided into two classes: (1) allergic manifestations of the early periods of the disease, chiefly in the form of hyperergic reactions of mesenchymal osteoarticular tissues, and (2) processes confined to one articulation or one osteoperiosteal segment, which are the sequelae of the accumulation of specific bacilli. Only the last mentioned group represents the authentic lesions of brucellosis.

Two groups of osteoarticular lesions may be distinguished, osseous and articular.

Osseous lesions in brucellosis are relatively rare and occur approximately in 2.8 per cent of all patients if the spinal column is excluded. From the anatomoclinical point of view two conditions may be distinguished, osteoperiostitis and osteomyelitis. The first mentioned condition may assume a simple form of reaction or may develop into a suppurative lesion. A simple reaction is characterized by pains and roentgenological findings, while suppurative conditions have a chronic evolution. Osteomyelitis may appear in an acute or chronic form. Osseous lesions produced by brucellosis are relatively benign and show a rapid tendency toward regression and reparative processes. Various types of chronic osteomyelitis, such as pseudotumoral, condensating, or inflammatory, have been described. The diagnosis may be difficult if the involvement of the bones appears in very early stages of the disease.

Articular lesions appear in approximately 40 per cent of all cases of brucellosis. They may assume two forms: pseudorheumatism and arthropathies. The first mentioned condition appears nearly exclusively in the acute periods of the disease and may be interpreted as an allergic reaction of the articular mesenchyma to the infection and the toxic effects of brucellosis. The condition may be monoarticular or polyarticular. Arthropathies may be classified as synovitis, arthritis, and osteoarthritis. Brucellosis shows a preference for primary localization in the osseous epiphyses, invading the articulations secondarily. As a rule, large articulations are affected. Generally, articular lesions of brucellosis are relatively benign and no important anatomic or fuctional sequelae are recorded. Occasionally an ankylosis may develop. Involvement of the spine has been found in as many as from 50 to 75 per cent of all

autopsies of patients suffering from brucellosis. As a rule, spondylitis appears in relatively late stages of brucellosis. Various distinct processes develop within the spinal column, viz., degenerative, destructive, and reparative. The process may involve intervertebral discs. Three forms may be distinguished: (1) generalized or circumscribed spondylitis, (2) a condition resembling Pott's disease, and (3) a spondyloarthritic form. The symptoms are those of an involvement of the spine due to any cause, namely, pain, muscular contractures, deformities, and the formation of abscesses. There are no characteristic roentgenological signs. Frequently osteophytic and exostotic formations are visible. The process is relatively benign.

The treatment should be directed toward the etiology. Spondylitis requires immobilization on Bradford's frame or in a plaster-of-Paris cast. Albee's operation may be considered if spondylitis is circumscribed and if an intervertebral disc is involved. Social, economic, and personal problems should be taken into consideration when a prolonged immobilization is contemplated.

JOSEPH K. NARAT, M.D.

Soule, A. B., Jr.: Mutational Dysostosis (Cleidocranial Dysostosis). *J. Bone Surg.*, 1946, 28: 81.

Mutational dysostosis, frequently transmitted by parents to offspring, is characterized by multiple, variable skeletal anomalies. The most prominent and frequent of these are aplasia of the clavicles, irregularities of dentition, and structural abnormalities of the jaws, skull, vertebrae, pelvis, femora, scapulae, metacarpals, metatarsals, and phalanges.

A careful survey of the English literature establishes that the first authentic case was reported in 1870, and since then the author's collected cases total 323, of which 198 are familial, involving 52 families. About half of the patients are males. Geographic distribution represents every continent. In the cases with a hereditary background, there has been transmission by male and female to a nearly equal degree. The condition may appear in several successive generations and then be lost and apparently not reappear in subsequent generations.

The etiology is associated with a defect in the parental germ plasm so that the anlage of the affected bones, both membranous and of chondral origin, is thought to be faulty. Various other theories and observations are presented; none is conclusive. Most of the skeletal defects found in mutational dysostosis are present at birth but may not be obvious until the child develops. The possible variants are so great that no one abnormality is characteristically found in all cases.

A comprehensive discussion of the abnormalities possible in this condition is given and illustrated with photographs and roentgenograms. The dental defects with their complications are most troublesome, and treatment in general is directed toward the alleviation of symptoms. Six cases, two pairs of which were related, are presented fully, and demonstrate the variability of the defects. The multiplicity of defects which may occur in this condition makes it rational that the term "cleidocranial dysostosis" be replaced by the more accurate and descriptive term "mutational dysostosis."

FRANCES E. BRENNECKE, M.D.

Smith, F. M.: Late Rupture of the Extensor Pollicis Longus Tendon following Colles' Fracture. *J. Bone Surg.*, 1946, 28: 49.

Late rupture of the extensor pollicis longus tendon following Colles' fracture is an unusual complication which results in disability that may be relieved only by operation on the tendon. The author has observed and treated 5 cases of this type on the Fracture Service of the Presbyterian Hospital, New York. These cases are described in detail with illustrations.

The complication has been previously described in the literature and the incidence was given as 1 to 270 Colles' fractures. At the Presbyterian Hospital, New York, the incidence was 1 to 268. The majority of the ruptures have occurred in the left wrist, and 4 of the 5 cases reported were in the left wrist. The complication is more frequent in females (60 per cent) and all 5 of the reported cases were in females. The tendon rupture is more common after the age of 30 years and the age incidence in this series was from 21 to 65 years of age.

The cause of the rupture has not been definitely established, but it probably follows rather late after acute or chronically repeated trauma. Factors such as partial laceration of the tendon by a spicule of bone, and trauma from forceful reduction of the fracture have been considered. Numerous cases of rupture have been reported when the fracture was minimally displaced or unrecognized and no reduction had been done. In 2 of the 5 cases reported the patients sought treatment late, that is, 19 days and 2 months, respectively, after their falls. Neither patient suspected she had a fracture and, since in neither case had the fracture been reduced or the wrist splinted, it was impossible to consider rough manipulation or faulty splints as a predisposing cause of the tendon rupture. In the 3 other cases the latent period of tendon rupture was 25 days, 27 days, and 6 weeks. From the operative and pathological findings in the 5 cases it is the author's belief that in rupture following Colles' fracture the cause is an aseptic necrosis due to interference with the blood supply of the tendon at the distal end of its groove on the radius.

There are no symptoms prior to rupture which would lead the surgeon to suspect a degenerative process in the tendon. A few patients describe a single sharp pain when the tendon ruptures, but most of them describe what they call a sensation of "something giving way," or a "snap" on the back of the wrist, followed by inability on their part to straighten or to lift the thumb actively. They may also note difficulty in picking up small objects such as pins. No subjective sensory changes are noted.

Physical examination reveals, first, a thumb that droops in its entirety, and, second, partial flexion of the distal phalanx. There is inability to elevate the thumb actively to the same level as the other metacarpals, and it is impossible for the patient to extend the distal phalanx actively against resistance, although this can be done passively. The ulnar border of the anatomical snuffbox is characteristically absent. Occasionally, the swollen degenerated end of the distal portion of the ruptured tendon can be felt beneath the skin and subcutaneous tissue as a small bump. There is no loss of skin sensation over the superficial distribution of the radial nerve.

The site of rupture in the extensor pollicis longus tendon is usually at the level of Lister's tubercle on the dorsum of the lower extremity of the radius. The distal portion of the ruptured tendon is usually drawn downward and the proximal portion usually retracts upward to the upper edge of the dorsal radiocarpal ligament or even more proximal to this. As much as 5 cm. sometimes separates the two tendon ends. Adhesions occur and the groove on the dorsum of the radius through which the tendon passes becomes obliterated. A specimen stained with Scharlach R showed the presence of fat between the tendon fibers.

In considering the operative repair of this condition, the author emphasizes that the extensor pollicis longus tendon has a dual function. Extension of the distal phalanx upon the proximal phalanx at the interphalangeal joint is probably the less important half of this tendon's function. Drooping of the thumb as a whole, which is observed in this complication, is due entirely to the loss of the oblique pull of the tendon. Any operative procedure designed to restore full function must, therefore, restore the oblique pull. Following experiences of the first 3 cases the author recommends suture of the distal end of the extensor pollicis longus to the extensor carpi radialis longus by end-to-side suture; following this, the tendon of the extensor pollicis brevis is also drawn over and sutured by a side-to-side suture. The first hookup gives the lift to the thumb and the extensor pollicis brevis adds extension to the distal phalanx. The ideal method of repair by resuturing the tendon ends or by implantation of a free tendon graft is prevented by the adhesions that are present; even if they were broken it would result only in bleeding that would produce more and denser adhesions. During postoperative immobilization the tendon would "freeze" and become nonfunctioning. Upon exploration and repair of the tendon the superficial branch of the radial nerve should be isolated and protected because damage to it may lead to distressing numbness of the dorsum of the thumb.

Following operative closure the hand, the wrist and forearm should be immobilized in a volar molded plaster splint in slight cock-up position with the thumb fully extended and elevated. The splint may be removed at the end of 10 days and the patient encouraged to begin moving the thumb very gently in flexion and extension. He should then be advised to remove the splint 3 or 4 times daily for exercises and for hot soaks. Usually at the end of 3 or 4 weeks it is possible to discard the splint completely, at which time the exercises are increased and the patient is encouraged to begin mild active use of the thumb.

In all of the 5 reported cases the patients showed improvement in function and use. The best follow-up results from a functional standpoint were found in the cases treated by the operation proposed by the author. CHARLES A. WALTMAN, M.D.

Guri, J. P.: Pyogenic Osteomyelitis of the Spine. Differential Diagnosis through Clinical and Roentgenographic Observations. *J. Bone Surg.*, 1946, 28: 29.

This article is based on 48 cases of pyogenic osteomyelitis of the spine. In order to arrive at the correct diagnosis, it was necessary to be very careful in the differential diagnoses. Some of the conditions considered in these diagnoses were acute appendicitis, the meningeal syndrome, and the back pain syndrome. The latter was divided into an acute form (16 cases), the subacute form (7 cases), and the insidious form (19 cases). Here the diagnosis rested between the differentiation of pyogenic infection from tuberculosis. The site of the pyogenic infections varied; they involved the spinous articular process, the transverse process, or the laminae. When pyogenic osteomyelitis involves the vertebral body, it may be divided into the localized or diffuse form. When the diagnosis is tuberculosis, in adults, areas of increased density are not frequently found in the roentgenograms of living subjects, except when there have been secondary infections, huge sequestra, or sudden collapse. There is a definite increase of density and sclerosis in pyogenic spondylitis; thus these features are diagnostic and permit the differentiation between tuberculosis and pyogenic spondylitis. RICHARD J. BENNETT, JR., M.D.

Hatcher, C. H.: The Pathogenesis of Localized Fibrous Lesions in the Metaphyses of Long Bones. *Ann. Surg.*, 1945, 122: 1016.

Because of the various secondary characteristics which are prominent in the course of localized benign fibrous lesions of bone, a variety of lesions have been described under various diagnoses. Philip and Burman and Sinberg described the lesions as solitary xanthomas, while Geschickter and Copeland called them variants of solitary bone cysts or benign giant cell tumors. Phemister described some localized nonsuppurative lesions of bone as fibrous osteomyelitis. Some of these would now be included in the lesions described as osteoid osteoma. In 1942, Jaffe and Lichtenstein demonstrated the various stages in the development of solitary fibrous lesions of bone, and interpreted them as benign tumors formed from mature marrow connective tissue. These were called nonosteogenic fibromas of bone.

The author reports on 51 lesions found in 45 patients and demonstrates the clinical, roentgenolog-

ical, and pathological findings in the various stages of the development and regression of the lesion. There were 28 males and 17 females. Five patients had multiple lesions. The lesions had their inception during the period of longitudinal growth. All of the lesions were in the long bones of the lower extremities. Jaffe and Lichtenstein found 1 lesion in the distal end of the ulna. All of the lesions were situated in the metaphysis or adjacent shaft, usually eccentric and abutting on the cortex.

The symptoms are usually mild and consist of intermittent moderate pain often referred to the adjacent joint, and local tenderness.

Roentgenographically there is a limited area of reduced density in the metaphysis, close to the epiphyseal disc, which in later cases elongates and has a sclerotic margin, usually scalloped, which gives the appearance of loculation. Later cases may show periosteal reaction.

The pathological appearance varies somewhat with the age and activity of the lesion. Fibrous connective tissue is the basis of the lesion in all stages. The recently formed focus shows a relatively cellular fibrous tissue with scattered multinucleated cells. The older lesions show fibrous tissue arranged in strands and whorls. Lymphoblasts are found scattered through the fibrous tissue. Lipoid filled macrophages are often present, grouped or scattered. The lipoid deposition is evidence of chronicity. Concomitant epiphyseal disorders were observed in 14 cases. Spontaneous healing of the fibrous metaphyseal lesions was usual. In only a few cases was surgical eradication necessary for the relief of pain. The etiology of metaphyseal fibrous defects is obscure. DANIEL H. LEVINTHAL, M.D.

SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Robertson, I. M., and Barron, J. N.: A Method of Treatment of Chronic Infective Osteitis. *J. Bone Surg.*, 1946, 28: 19.

The authors' treatment of chronic infective osteitis is based on the principle of extensive excision of all diseased tissues, including skin, deep scars, and infected bone, and the replacement of soft tissue defects by muscle and skin flaps, and of bone defects by bone transplants.

This procedure may require two or three operative stages. In the first stage, all of the diseased tissue is excised and a split skin graft is applied to the wound surface. In the second stage, there is a plastic repair of the soft tissues. The original split skin graft is removed and the area is covered by a skin and subcutaneous flap, muscle being included where necessary. Stage three consists of repair of the bone graft. In some cases, the second and third stages may be combined. An interval of 4 weeks is suggested between the first and second stages, and one of at least 8 weeks between the second and third stages. In some cases, the full diameter of the shaft of the bone may be involved.

Several diagrams, photographs, and roentgenographs are included in the original article. The details of the operative care in the three stages are discussed at length. A word of warning is given that this is not an undertaking to be lightly embarked upon by the operator.

RICHARD J. BENNETT, JR., M.D.

Starr, D. E.: Congenital Absence of the Radius. *J. Bone Surg.*, 1945, 27: 572.

Three cases (involving four limbs) of congenital absence of the radius in its various aspects have been seen by the author.

The most interesting was a bilateral case with congenital absence of the radius, the thumb, and the first metacarpal bones. The 2 other patients showed partial or complete absence of the radius and absence of some of the carpal bones. This deformity is disabling and very unsightly.

A three-stage procedure is carried out whereby skeletal traction is applied, ulnar osteotomy is performed, and a fibular transplantation is carried out. The end result is particularly good in that it allows forearm rotation and wrist motion when part of the radius is present, and presents an extremely improved appearance.

RICHARD J. BENNETT, JR., M.D.

Aitken, D. M.: Late Results of Albee Fixation of Tuberculosis of the Spine. *Proc. R. Soc. M.*, Lond., 1945, 38: 685.

The author states that during the past 40 years the treatment of tuberculosis of the spine has passed through two phases and entered the third. The first phase consisted of fixation of the affected joints on a controlling splint until all pain and swelling had disappeared and the patient's condition was thriving. The second phase may be said to have begun about 1911 and was first applied in Robert Jones' practice, mainly to tuberculous disease of the spine. It consisted in the addition of a bone graft with the object of securing extra-articular fixation and bridging the diseased area to secure more comlete fixation.

The third or present phase is based on the extraordinary results which followed successful employment of the Robertson-Lavalle technique which is briefly outlined. This procedure consists of drilling tuberculous foci, which are believed to contain some defensive substance which cannot escape into the general circulation on account of the constriction of the issuing capillaries by the tough capsule about the focus. Drilling into the focus is supposed to let this mysterious substance out into the systemic circulation. Only "young foci" are drilled. These show on the x-ray as faint blurred areas of decreased density.

Use of the procedure is said to be followed by marked improvement in the well-being of the patient. Pain usually disappears quickly, and the degree of sepsis is lessened.

VERNON C. TURNER, M.D.

Dick, I. L.: Iliac Bone Transplantation. Preliminary Observations. *J. Bone Surg.*, 1946, 28: 1.

More than 20 years ago Albee stated that transplanted bone lives and grows in the same way that a transplanted twig grows in the tree into which it is grafted. Leriche and Policard and others held that transplants of bone always die and are replaced by cells originating in the host bone, and that such transplants form only a framework for the ingrowing bone. Phemister, Hey Groves, Campbell and Ghormley and Stuck showed that some of the bone cells, those near the periosteal or endosteal surfaces or in the haversian canals, live, grow, and form new bone. The cells deep in the dense cortical bone die and are replaced. Imbert stated that this process is carried on in all parts, but not simultaneously.

This supplies the evidence that cortical bone has the advantage of strength and stability, while cancellous bone is better for osteogenesis.

The two areas of the ilium most favorable as donor sites for cancellous grafts are just behind the anterior superior spine and the posterior wing of the ilium near the posterior superior spine. The latter site provides a more abundant supply of cancellous bone.

Cancellous bone grafts are of value in arthrodesing operations, in the repair of bone defects, and in delayed union and nonunion. A cortical graft may be necessary for stability and contour.

DANIEL H. LEVINTHAL, M.D.

FRACTURES AND DISLOCATIONS

Gibbens, M. E.: An Appliance for the Conservative Treatment of Acromioclavicular Dislocation. *J. Bone Surg.*, 1946, 28: 164.

It is pointed out that acromioclavicular dislocation heals without deformity if held in place for approximately 6 weeks.

A cast is applied to the arm on the side of the separated acromioclavicular joint from the axilla to the metacarpophalangeal joints. A U-shaped metal plate is incorporated in the upper portion of the cast. An elastic band is placed over the lateral end of the clavicle and attached to each end of the metal piece under tension. Elastic traction is maintained for 6 weeks. The author states that he used this type of reduction on approximately 10 or 12 patients.

No x-ray treatment is given before or after reduction. GEORGE I. REISS, M.D.

Henderson, M. S.: The Fibular Bone Graft in Ununited Fractures of the Neck of the Femur. *West. J. Surg.*, 1945, 53: 422.

Extra-articular osteosynthesis, with the fibula as a bone graft, has given a satisfactory percentage (88) of good results in 22 cases of ununited fracture of the neck of the femur. In 15 of 17 cases in which the patients were traced, bony union was secured. Furthermore, in 12 the results can be called excellent in that the patients walk without a cane or crutch and with little or no limp, and they can put on their stockings and shoes with no inconvenience. In 3 cases the results were classified as good in that skeletal support was provided and the patients walked without aid, but motion was only fair. In 2 cases the results were failures and union was not obtained. No deaths resulted and no complications were noted. One patient could not be traced and 4 were operated on too recently to warrant recording of the end result. Of these 4, 3 are up and around on crutches and show every evidence that the operation will be successful. Roentgenograms show the bone grafts to be in excellent condition and it is anticipated that the end results will be quite satisfactory. One patient is still in the hospital.

The overriding deformity must be overcome by traction (either skin or skeletal) before operation so that the graft can be inserted at an angle to the shaft as near to the normal 125 to 127 degrees as possible. This gives the graft a more favorable position to resist the shearing force during convalescence than if it is inserted at a lesser or a 90 degree angle.

The surgeon must have the proper instruments and the steps of the operation must be checked by roentgenograms or the fluoroscope.

Barr, J. S., Draeger, R. H., and Sager, W. W.: Solid Blast Personnel Injury. A Clinical Study. *Mil. Surgeon*, 1946, 98:1.

The clinical findings and treatment of 50 patients who suffered solid blast injuries are reported. Three types of shock waves are generated by the blowing up of "high explosives" and cause characteristic injuries: (1) shock waves generated by an explosion may stun and kill a man (air blast); (2) shock waves generated by an underwater explosion may cause lethal intrathoracic and intra-abdominal injuries (underwater concussion); and (3) shock waves transmitted through solid structures, as those received on ship deck or in a tank, may produce solid blast injuries.

The explosion of mines, torpedoes, or aerial bombs generates a force which strikes the ship structure with an initial wave characterized by relatively small displacement but extremely high acceleration. It is as if a giant hammer had struck the hull of the ship. The initial inpact is followed by secondary flexions and oscillations of the entire ship's structure. The shock wave hitting the ship is transmitted to the personnel aboard the ship, and its effect will naturally vary according to the position, distance from the explosion, contact with the ship's body, and many other factors relating to the individuals on board.

The bursting effect is of great magnitude and directly causes fractures of the bones of the legs and rupture of the skin and subcutaneous tissues. An individual may also be thrown a great distance and sustain fractures when falling, but such secondary injuries were not considered in this article.

The most common injuries caused by a solid blast are multiple compound, comminuted fractures, and fracture dislocations of the ankle and tarsal bones.

Dislocation of the knee joint is frequently associated with peroneal nerve injury and rupture of the popliteal artery. The latter complication occurred in 10 legs which had to be amputated because of subsequent gangrene.

Thirty-two patients were unconscious for periods varying from a momentary lapse to several days. They were thrown in a vertical direction up to 115 feet and horizontally up to 200 feet.

The first aid treatment of solid blast injuries is primarily devoted to saving life, i.e., the treatment of shock, splinting of the injured parts, and evacuation to safer places for definitive medical care.

The final management of these patients follows along well known lines. It is noteworthy that skeletal fixation devices (Roger-Andersen, Stader) were found to delay union and cause osteomyelitis around the pin holes. Sailors who were in their bunks at the time of the explosion suffered the least injuries.

In conclusion, 13 case histories are described in detail. GEORGE I. REISS, M.D.

ORTHOPEDICS IN GENERAL

Bateman, J. E.: A Universal Splint for Deformities of the Hand. *J. Bone Surg.*, 1946, 28: 169.

A splint is presented for the maintenance of adequate immobilization of the wrist and fingers deformed as a result of nerve injury. This apparatus prevents overstretching, eliminates undue pressure on devitalized tissues, and avoids stiffness due to prolonged immobilization. Stiffness is avoided by removing the device twice daily, and actively and passively moving the immobilized parts. This process is made very simple by the construction of the universal splint.

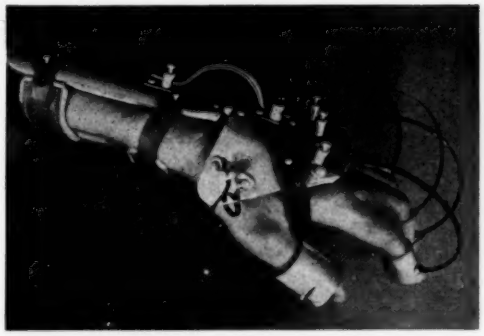


Fig. 1. The splint is applied in a paralysis of the median nerve, requiring finger and thumb correction. Note that the thumb may be pulled from the position of adduction.

The splint consists of a universal holder to which accessories consisting of steel arches (0.125 by 0.025 inch) twisted in a coil are attached. The spring arches are held on the holder by studs on fixed swivels.

The splint can be used as a posterior splint, as an anterior splint, and as a combination splint.

GEORGE I. REISS, M.D.

SURGERY OF THE BLOOD AND LYMPH SYSTEMS

BLOOD VESSELS

Gross, R. E.: Surgical Correction for Coarctation of the Aorta. *Surgery*, 1945, 18: 673.

Researches on dogs were carried out which indicated that the aorta could be completely transected and a normal vascular pathway reconstructed.

Two case reports are included in which the constricted area of the aorta was resected. In the first case the patient died of cardiac dilatation said to be due to the fact that the blood was allowed to re-enter the great vascular bed in the lower part of the body too rapidly. In the second case a 12 year old girl was studied and prepared for operation. The operation was carried out successfully in June, 1945. The constricted area was resected and a satisfactory end-to-end anastomosis was completed. The patient made an uneventful recovery.

It was interesting to note that the blood pressure in the lower extremities came up to the normal level over a period of several days, while the hypertension in the upper extremities gradually decreased over a number of days. RICHARD J. BENNETT, JR., M.D.

Paul, M.: The Surgical Treatment of Traumatic Aneurysms. *Brit. J. Surg.*, 1945, 33: 113.

The surgical treatment of large aneurysms is attended with difficulty and danger, and the successful management of such cases demands a high degree of technical skill together with a proper appreciation of the problems of this branch of surgery. The author presents detailed reports of 8 cases. These indicate how problems have been met in individual instances that are not so common as to be within the experience of most surgeons.

A brief history of the surgical treatment of aneurysms is presented. The risk of gangrene of a limb following an operation in which the blood flow through the main artery has been obstructed by the operative procedure should be minimized as far as possible. If the arteries distal to the aneurysm exhibit a normal pulsation, it is clear that most of the blood is still traveling through the main artery. In the traumatic cases the aneurysm is likely to be saccular and suitable for treatment by the restorative endoaneurysmorrhaphy method of Matas, which carries almost no risk of interference with the main circulation through the limb. If, on the other hand, there is no pulse in the arteries distal to the aneurysm, it is clear that the circulation is being carried on mainly by collateral vessels, and Matas advocates that the deficiency of the collateral circulation be estimated by the following method:

The limb is blanched by elevating it and by the application of a firm elastic bandage. The main artery is now compressed above the aneurysm, the elastic bandage is removed, and the limb lowered. If the collateral circulation is efficient, there should be a blush in the blanched limb within 3 minutes. If the collateral circulation is deficient, it can be improved by removing the sympathetic vasomotor control to the limb either by the operation of sympathectomy, or more temporarily by the injection of the sympathetic field with novocain.

In conclusion, the author notes that among the 8 cases of aneurysms described, the aneurysm was traumatic and saccular in 4 and the arteries distal to the aneurysm exhibited almost normal pulsation. In these cases the Matas operation for reconstructive endoaneurysmorrhaphy proved thoroughly practicable, the patient being cured by the operation.

In 3 cases the aneurysm was traumatic and fusiform. The arteries distal to the aneurysm showed no pulsation. Matas' obliterative endoaneurysmorrhaphy served, however, to cure these patients of their aneurysms. In 1 case, which unfortunately proved fatal, the aneurysm was due to the rupture of an arteriosclerotic calcified vessel. In this case the aneurysm had caused gangrene of the foot, which necessitated a disarticulation through the hip joint.

HERBERT F. THURSTON, M.D.

Buxton, R. W., and Coller, F. A.; Surgical Treatment of Long Standing Deep Phlebitis of the Leg. A Supplementary Report. *Surgery*, 1945, 18: 663.

In the group of cases studied, the long standing deep phlebitis of one or both lower extremities had its onset from 2 months to 30 years previously. Ligation of the femoral vein was carried out in individuals who had pain or disability resulting from chronic deep thrombophlebitis. The authors suggest that ligation of the femoral vein should not be carried out beyond the age of 55 years because of the advanced arterial diseases. Superficial varices were treated by ligation before the femoral vein ligation was carried out. The injection method of treatment of varicose veins was not used before, during, or after femoral ligation and none of the patients had received lumbar sympathetic block before, during, or after femoral vein ligation.

Of the 14 patients with ulceration, 6 have had complete healing of the ulcers for 1 year or longer. Others were healed for a shorter period of time. In 2 patients the areas are still unhealed. Reports indicate that there has been little improvement in the degree of swelling as compared with the preoperative status. Fatigue without exception continues to be a permanent symptom. When involvement was present above the level of the profunda femoris, vein ligation of the common femoral vein was carried out. It is believed that the level of vein ligation above or below the profunda femoris branch bears little relation to the degree or duration of postoperative edema, to the appearance of superficial varices postoperatively, or to the end result.

The common iliac vein was ligated in 1 patient. Postoperative lumbar procaine injection produced little change in the patient's leg.

The inferior vena cava was ligated in 7 patients with a longstanding phlebitis of both lower extremities. The first patient upon whom a ligation of the vena cava was performed has now passed the twelve month period following it, and has no edema, although a prolonged trial without external supports has not been made. All the other patients in this group are still wearing supports. The outstanding end result in ligation of this type is the high incidence of healing of ulcers due to stasis. The most disappointing results have occurred in patients upon whom ligation was carried out when such ulceration was not present. The treatment has not been very satisfactory in this group.

RICHARD J. BENNETT, JR., M.D.

BLOOD; TRANSFUSION

Corelli, F.: The Rh Factor, the Cause of Fetal Erythroblastosis, Hemolytic Disease of the Newborn, and of Transfusion Reactions (Il fattore Rh causa dell'eritroblastosi fetale, malattia emolitica del neonato, e di reazioni da trasfusione). *Policlinico (sez. prat.)*, 1945, 52: 369.

This article is almost entirely a review of the American and English literature on the Rh factor, which has already been ably reviewed. Its purpose is to acquaint such part of the Italian medical profession as is not already well acquainted with the subject—with the possibilities in the diagnosis and treatment of anemias, edemas, purpuras, and icteric conditions of pregnancy and infancy, and with the explanation of many instances of abortion or premature delivery. Of course, many Italian doctors have been working in this field; for instance, Pontano has been transfusing with blood which is negative to the N factor.

The author himself finds an explanation of some of the mishaps in the past. For instance, 1 of his recently observed patients, who 3 years previously had received a number of transfusions without incident, received another harmless transfusion, incident to the development of a marked hypoplastic anemia. Thirteen days later she received another homogroup transfusion, which was succeeded an hour later by a typical severe reaction. Of course, the mishap might be ascribed to the inadequacy of the crossmatching tests and even of the so-called biological test (an initial injection of 20 c.c. of the donor's blood with observation for 5 minutes thereafter). However, the author thinks that the patient had received blood in one of the previous transfusions which was positive for the Rh factor; then in the first of the current two transfusions the blood was Rh negative; and in the second it was Rh positive and this brought on the reaction. However, the patient fortunately recovered.

Considerable space is given to the correspondence section of the *Journal of the American Medical Association* (1945, 127: 1146) in which Darrow claims that Rh positive blood should not be harmful to the erythroblastic infant. She postulates the correct methods of treatment for the condition, reserving perhaps for further study the question of transfusion with Rh positive blood, and her opinions are accepted without reserve. The author also, with apparent benefit, has alkalinized the urine with bicarbonate of soda (4 gm. every 4 hours), and administered sodium lactate (Fox: *J.Am.M.Ass.* 1944, 124: 127) for burn patients.

The author is now trying to build up a roster of Rh negative donors at the Uniti Hospital in Rome and intends to study further, not only the question of the Rh factor, but also the possibility of explaining the surprise reactions among the homogroups themselves in which the Rh factor does not always seem to be culpable. These reactions occur even in the O group and are possibly due to other as yet little noticed factors, such as the factors M, N, and P. He believes that other matters also should be included in these investigations, such as the influence of the Rh factor in the unexplained occurrence of mental debility in children, as a high percentage of Rh positive infants delivered from Rh negative mothers has been found to be mentally deficient.

All of the aspects of this problem have been included under a broader conception which the author has designated as "Hemopathic Allergy." His book on this subject was published in 1944 by the publishing house of Pozzi in Rome.

JOHN W. BRENNAN, M.D.

LYMPH GLANDS AND LYMPHATIC VESSELS

Moreton, R. D.: Lymphosarcoma, with Primary Manifestations in the Gastrointestinal Tract. Report of 7 Cases Studied Roentgenologically. *Texas State J. M.*, 1946, 41: 458.

Lymphosarcoma is defined by Ewing as a true malignant neoplasm arising in lymphatic tissue from proliferation of atypical lymphoid cells. This occurs as (1) a localized or (2) a diffuse process. It is one of the larger groups of tumors referred to as malignant lymphoma or lymphoblastoma and should be classified under this general heading.

Because of the relative rarity of this condition the author thought it was advantageous to present a brief review of the pathological and roentgenographic findings, as well as to present 7 cases of lymphosarcoma which manifested themselves as gastrointestinal lesions and were studied roentgenographically.

Two types of this tumor are recognized: the small cell lymphosarcoma or malignant lymphocytoma, and the large cell or reticulum cell lymphosarcoma. Some authorities believe the distinction between the two types is important from both therapeutic and prognostic standpoints. In the gastrointestinal tract the growth originates in the submucosa and invades in each direction, involving, on one hand, the

mucosa, and, on the other, the muscularis of the bowel.

In summarizing, the author notes that the term, "tumefactive lesion" should be a useful one in the roentgenological field just as in gross pathological diagnosis. This term is used as a general one and does not define a specific etiologic or histological process, and is therefore used before the more refined methods of diagnosis are employed.

Radiologists are among the first to believe that roentgenological examination can be made to establish the presence of any tumefactive lesion in the gastrointestinal tract at least as early in the anatomic development of the lesion as the latter is able to cause symptoms and be manifested by clinical signs. A neoplastic lesion may be distinguished from a non-neoplastic lesion with about the same accuracy after the examination of the gross specimen. Surgical exploration has substantiated these beliefs to the extent that such roentgenological capabilities are well recognized.

Due to the rarity of lymphosarcoma as compared to carcinoma, as well as the similarity of lymphosarcoma in the gastrointestinal tract to that of carcinoma in the same location, there is the tendency to report all of these lesions as carcinomas rather than tumefactive lesions or malignant neoplasms at the particular site noted.

In this condition the roentgenological findings are not sufficiently characteristic to allow a specific diagnosis of lymphosarcoma of the gastrointestinal tract, and for the reasons which have been stated carcinoma is the diagnosis that is most frequently made.

In conclusion, the author states that 7 new cases of lymphosarcoma with primary manifestation in the gastrointestinal tract have been presented. The series included 5 women and 2 men. The youngest patient was 51 years of age; the oldest, 74. No distinguishing features of lymphosarcoma were found either in the history or on roentgenological examination. The 7 lesions viewed roentgenologically had an appearance indistinguishable from that of carcinoma.

All patients were subjected to an exploratory operation, the diagnosis being made from biopsies. Five of them were subjected to postoperative roentgen therapy as noted in the case reports. Five of the 7 patients have died: one, 10 days postoperatively of bronchopneumonia, and the others, 7½ months, 20 months, 16 months, and 2 months, respectively, after first being seen at the clinic, apparently from the lymphosarcoma.

Two patients with involvement of the stomach were last seen at the clinic 34 and 36 months after their first admission. They showed no evidence of recurrence. One of these patients had been treated by resection and postoperative irradiation; the other received irradiation alone.

HERBERT F. THURSTON, M.D.

SURGICAL TECHNIQUE

OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

Smith, B., Cornell, C., and Neill, C. L.: Principles in Early Reconstructive Surgery of Severe Thermal Burns of the Hands. *Brit. J. Surg.*, 1945, 33: 155.

Regulations directing the proper use of protective fire resisting apparel will reduce burn hazards in military operations. Characteristic wartime burns of the hand involve the tissue over the dorsum of the hand and fingers, and have a tendency to encircle the wrist.

Deformity and disability resulting from thermal burns of the hands may be reduced by early management. The initial treatment is directed toward the prevention of infection and the restoration of function. However, infection and exposed tendons and bones do not contraindicate early grafting. Radical excision of slough, granulation tissue, and poorly developed epithelium prepares the recipient surface for a split thickness graft which is sutured in place under the tension of normal skin.

Postoperatively, dressings and splints are removed on the fifth day. Rehabilitation exercises are resumed until maximum functional activity is obtained.

LOUIS T. BYARS, M.D.

Levenson, S. M., and Lund, C. C.: Dermatome Skin Grafts for Burns in Patients Prepared with Dry Dressings and with and without Penicillin. *N. England J. M.*, 1945, 233: 607.

Up to the time of the work presented in this report, the results of skin grafting at the Boston City Hospital were similar to those reported by Hirshfeld *et al.*, namely that in about one-third of the cases there was less than 75 per cent take, and in many of the cases the failure was 100 per cent. It was therefore decided to try the use of penicillin given parenterally.

Twenty-eight dermatome grafts were done on 19 patients with granulating third-degree burns. One-half of the patients received parenteral penicillin treatment before and after grafting, and the other half received no penicillin.

In other respects the techniques used in the two groups were identical. Before and after grafting dry sterile pressure dressings were applied with adequate splinting. The condition of the patients, the extent and site of the burns, and the extent of the graft were similar in the two groups.

All granulating areas were locally infected, but there were no cases of spreading infection.

The hemolytic staphylococcus aureus, the proteus vulgaris, and the pseudomonas aeruginosa were the predominant organisms.

Penicillin had no effect on the bacterial flora or the appearance of the wounds.

The results obtained in both of the groups were excellent.

Simple dry sterile pressure dressings, infrequently changed, are recommended before and after skin grafting.

It appears that the improvement in the results of skin grafting of granulating third-degree burns at this hospital that was coincident with the start of this study was not due to penicillin, since the results in the patients who did not receive penicillin were essentially the same as those in the patients who did receive it. It should be emphasized, however, that the results in the control cases were such that the takes in the penicillin treated series would have had to be essentially perfect in all cases to show a significant improvement. There was no change in the cultures from, or in the appearance of, the granulating wounds during the period of penicillin treatment. It should be stressed, however, that there were no cases of septicemia or cellulitis, the infection being confined to local areas.

DANIEL H. LEVINTHAL, M.D.

Schmidt, E. R., and Hibma, O. V.: Mortality after Operation. *West. J. Surg.*, 1945, 53: 427.

The authors have reviewed all deaths (128) following operations done at the Wisconsin General Hospital, Madison, in the year 1942. Classification of these cases, on the basis of evaluation as to the risk of the given procedure shows that other factors, such as the type and amount of surgery, play a greater role.

Although the majority of deaths occurred in the fourth, fifth, and sixth decades, it was believed that more operations are done in these age groups and that the mortality is actually highest in the very young and the very old.

A review of the deaths occurring from 1938 to 1942, classified according to the recommendations of the American Society of Anesthetists, shows a very direct correlation, the mortality varying from 0.085 per cent for those in the best physical state to 57.5 per cent for those practically moribund before operation.

Seven deaths in the operating room are reported with brief abstracts. The author points out that if one is more interested in relieving the sufferings of the patients than in the mortality rate the deaths are unavoidable. More than half of the 128 patients died after the third postoperative day.

Three conditions accounted for 45 per cent of the deaths: pneumonia (19.5%), central nervous system failure (14.8%), and cardiac failure (12.5%). Other causes are listed.

The authors emphasize that evaluation as to risk is important; that risk varies with the experience and the clinical judgment and acumen of the surgeon and anesthetist; that routine orders are dangerous; and

that close attention to particular systems without neglect of the patient's general condition is essential.

THOMAS C. DOUGLASS, M.D.

ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

Weinstein, L., and Wesselhoeft, C.: Penicillin in the Treatment of Tetanus. *N. England J. M.*, 1945, 233: 681.

Two cases of severe tetanus are reported in which recovery followed treatment with large amounts of antitoxin, surgical excision of the wounds and administration of large doses of penicillin.

Bacteriologic studies revealed that clostridium tetani could no longer be isolated from the wounds in these patients 24 hours after the first administration of penicillin. The already demonstrated antibiotic influence of penicillin on this organism in vitro, therefore, appears to be confirmed in vivo.

The use of penicillin in tetanus appears to be most valuable in cases in which multiple lesions, not all of which can be removed by surgical means, are present or in which no focus of infection is detectable. This antibiotic agent is not intended to replace the administration of antitoxin, excision of wounds, adequate sedation, and maintenance of a normal state of nutrition and hydration, but appears to be a highly important adjuvant to these other therapeutic measures.

McAdam, I. W. J.: Penicillin Treatment of Acute Hematogenous Osteomyelitis. *Brit. J. Surg.*, 1945, 33: 167.

The lifesaving properties of penicillin are discussed, and its limitations in local infection and bone necrosis are emphasized in conjunction with 40 patients in whom penicillin treatment was used. The long bones were affected in 32 of the patients. The usual daily dose of penicillin was 100,000 units; larger doses were used when indicated. Quite a wide variation in the serum level of penicillin was found.

Intramedullary injections of the penicillin produced a higher concentration in the pus. The intramedullary method is recommended when the infected metaphysis is intracapsular and there is an almost inevitable septic arthritis. It would appear from the results reported here that a route for the passage of penicillin from the metaphyseal focus to the infected joint cavity is open. The introduction of a needle into the medulla of an infected bone serves several purposes: it allows the aspiration of a subperiosteal abscess; it relieves intramedullary tension; and it allows a bacteriological diagnosis to be made from the pus; in addition, it is used to administer the penicillin.

The length of time that organisms are found in the medullary cavity is very important in order to decide the duration of treatment. Among 18 patients, the average time for staphylococcal infections to be cleared up was 14 days, and the treatment was continued until three successive daily specimens of pus proved to be sterile. The temperature chart and leucocyte count were not found to be reliable as guides to the severity of the local infection. Of 40 patients, 21 had a generalized infection, 10 had metastatic foci, and 20 had positive blood cultures.

A large table is given in the original article, showing the details of treatment in 40 cases of acute hematogenous osteomyelitis. Among 32 patients with acute infections of the long bones treated with penicillin, 5 had operative treatment and the remaining 27 were treated conservatively. In 10 of the 40 patients, septic arthritis occurred. This complication is most effectively treated by the aspiration of pus and the local injection of penicillin into the joint cavity every second day. Among 22 of the 32 patients who had infections of the long bones, 2 have poor function because of destruction of a joint; 1 patient developed a pathological fracture; and 2 patients have discharging sinuses. In the remaining 17 patients, good function has resulted.

Penicillin treatment sterilizes bone in an average of 14 days. Before sterilization, however, bone damage has occurred, even though it is not evident roentgenographically. Immobilization would appear to be advisable until there is roentgenographic evidence of recalcification.

In this series of 40 patients, 19 had a staphylococcal septicemia, 9 had metastatic lesions, and 10 had a septic arthritis; there was 1 death.

RICHARD J. BENNETT, JR., M.D.

Kirby, W. M. M., Leifer, W., Martin, S. P., Rammelkamp, C. H., and Kinsman, J. M.: Penicillin in Oil. *J. Am. M., Ass.*, 1945, 129: 940.

Penicillin-beeswax-peanut oil mixtures provide an effective and safe means of prolonging the action of penicillin in the body. Studies were made of the absorption and excretion of penicillin following intramuscular and subcutaneous injections of 300,000 units of penicillin in a 4.8 per cent beeswax in oil mixture. A single injection was administered to 54 patients with acute gonococcal urethritis, and 35 patients with primary or secondary syphilis received 8 daily injections, a total of 2,400,000 units in 8 days.

Calcium penicillin was used rather than the sodium salt because it was less hygroscopic, although there was thought to be no significant difference in the duration of the blood levels or in the clinical results because of the particular salt used. Penicillin was suspended in a 4.8 per cent beeswax in oil preparation. Intramuscular injections were made into the gluteal or deltoid muscles, and subcutaneous injections, into the subcutaneous tissues overlying the insertion of the deltoid muscle. The variability of absorption and excretion was striking, the important factor being the location of the injected material in relation to the muscle tissue and fascial planes, while the activity of the patient was apparently of minor consequence. It was concluded that there must be a continuous absorption from the muscle of a large amount of penicillin to insure ab-

sorption of about 2,500 units per hour. Slower, more uniform absorption was obtained with subcutaneous injections, because there are fewer and smaller blood vessels in the subcutaneous regions than in the deep muscle tissues: therefore this route was considered superior, although it was used in only 25 cases in this series.

Penicillin levels in the blood and in the urine were obtained in the 89 cases. The blood levels were determined by the Kirby-Rantz modification of the Rammelkamp serial dilution technique (which detected as little as 0.04 units per cubic centimeter), and specimens were taken ½, 1, 4, 8, 12, 16, 20, 24, and 28 hours after the injection. In 69 per cent of the 54 patients with gonococcal urethritis the blood levels were present for no longer than 12 hours, and in about half of the 31 per cent in whom the levels were present for from 16 to 28 hours, irregularity of absorption during the second 12 hours was noted. In only 7 per cent of the 35 luetic patients assayable levels of penicillin were present 24 hours after each injection. No cumulative effect of penicillin was noted. In both groups of patients urine was collected in 12 hour periods for from 48 to 72 hours and follow-up clinical observations were performed for a minimum of 21 days. The excretion of penicillin was found to decline rapidly after the first 12 hours, but small amounts could be detected for 72 hours or more. The urinary excretion confirmed the evidence of superiority of the subcutaneous over the intramuscular route of injection.

In the one-third of the patients who received subcutaneous injections it was observed that the absorption was more uniform and the levels were more prolonged; in approximately two-thirds of these patients penicillin was present in the blood in detectable quantities for 24 hours or more.

From the preliminary clinical results it is concluded that, although larger amounts of penicillin are required than with penicillin in saline solution, penicillin-beeswax-peanut oil mixtures provide an effective and apparently safe method of prolonging the action of penicillin in the body. It is further concluded that an injection of the penicillin in oil mixture (300,000 units) should be made twice a day for treatment of infections in which it is desirable to maintain a therapeutic concentration of penicillin throughout the duration of treatment.

Soreness at the site of injection which persisted for 9 or 10 days was the only significant manifestation of the penicillin in oil injections (3 of the luetic cases developed a generalized urticaria), and this was less severe in the subcutaneous administration.

PHILIP B. CHASE, M.D.

ANESTHESIA

Pleasance, R. E.: Intravenous Anesthesia in the Tropics. *Current Res. Anesth.*, 1945, 24: 231.

This article is based upon experiences at a Base Hospital, and covers a period of 2½ years with intravenous anesthesia, mainly pentothal sodium. During this period, 3,994 of 7,952 anesthesias, approximately 50 per cent, were intravenous anesthesias of some form. There were no fatalities in this series and no definite postoperative pulmonary complications. The operative cases varied considerably and included most types of minor surgery and diagnostic procedures, as well as maxillofacial, plastic, orthopedic, and extensive surgery of the cranial vault, chest, and abdomen. Pentothal alone was used when possible but the more extensive procedures were performed under a combination of pentothal and some other form of anesthesia, preferably gas and oxygen.

The author lists the following types of cases as suitable for intravenous anesthesia:

Patients who desire to avoid unpleasant inhalation agents.

Patients who resist other forms of anesthesia.

Patients who are unable to tolerate a mask over the face.

Patients who have had little or no premedication.

Patients who require a supplement to spinal anesthesia.

Patients who are subjected to minor operations, manipulations, or examinations under anesthesia.

Patients who are subjected to selected major operations.

Patients who require an antidote to the toxic effect of local anesthetics.

Patients who are having convulsions from drug poisoning, ether, or tetanus.

Patients who require sigmoidoscopic or cystoscopic examinations or application of the diathermic cautery.

The tendency toward laryngeal spasm makes the use of pentothal for bronchoscopy hazardous unless an expert in the arts of both anesthesia and bronchoscopy administers the pentothal. Lundy's method of reinforcing the preliminary infection after a few minutes of waiting and proceeding to a deep plane is advocated.

The following patients are not suitable for intravenous anesthesia:

Children under 7 years of age

Patients with severe liver and kidney disease

Patients with suppuration in the neighborhood of the neck

Patients with cystitis and latent pyelitis

Possibly patients with asthma and those who have been treated with preparations of sulfanilamide, those with dyspnea from any cause, with severe anemia, cachexia, and dehydration, with cardiac decompensation, with hypotension, or with varicosities are also unsuitable for intravenous anesthesia.

In this extensive series, the author noted some complications such as venous thromboses, severe headache, unusual urticarial-like erruptions, vomiting, exacerbation of latent malaria, priapism, jactitation, and intra-arterial infections eventuating in the loss of the extremity.

Since barbiturates are broken down in the liver and excreted by the kidneys, great care must be

exercised in the use of pentothal in a tropical climate, where liver disease or deficiency is comparatively common. The fall in blood pressure and depression in respiration depend upon the rapidity with which the anesthetic agent is injected. The four stages of anesthesia discussed are: light narcosis, the "stage of inebriation," anesthesia, and "premortem."

Induction, as well as recovery, is quiet, but occasionally the patient is irrational, noisy, and hyperactive. Whenever possible, the solution (2.5%) should be freshly prepared at least 10 or 12 minutes before injection. Preoperatively, the patient should be prepared as for a general anesthetic, and if the procedure requires a prolonged anesthesia, morphine (gr. ¼) and atropine (gr. 1/100–1/150) should be given. The following techniques of administration are used: (a) the single dose; (b) the intermittent dose; and (c) the continuous dose. These techniques were dependent on whether the case was (1) a simple surgical procedure, (2) a general surgical procedure requiring prolonged anesthesia, (3) a cerebral case, (4) a case of maxillofacial surgery, or (5) a case of thoracic surgery. Postoperatively, routine use is made of one of the detoxicant drugs—coramine, phrenazol, or picrotoxin, and the patient is carefully watched until the return of reflexes or even consciousness. The author judiciously concludes, "The ease of its administration may constitute the greatest danger of pentothal." DAVID H. LYNN, M.D.

Edwards, G.: Tribromethyl Alcohol (Avertin, Bromethol). *Proc. R. Soc. M.*, Lond, 1945, 39: 71.

The author describes the first case narcotized by avertin in England as well as additional experiments with the drug up to the present time. It is now being administered routinely.

This drug has had widespread popularity from its initial introduction into England in 1927. In 1936, 20 per cent of the hospital patients and 65 per cent of the patients in nursing homes were given avertin. However, its popularity has waned since that time; during the last 12 months, less than 5 per cent of the hospital cases and less than 10 per cent of the private patients have received this drug. A 1/10 gm. per kilogram dose has been used from the start. The original 3 per cent solution used has been changed to a 2½ per cent solution. The Congo red test was used to determine traces of hydrobromic acid. Rectal plugs and postoperative washouts were used at first but were soon discarded as worthless. It was soon learned that avertin should be given as a basal anesthetic only; total anesthesia with the drug was found to be dangerous.

Avertinized patients retain an active cough reflex. Coramine gives an effective counteraction to an overdose. Although avertin is unlikely to damage a healthy liver, it should be avoided if there is any suspicion of impaired hepatic function. It has little effect on renal function and nitrogen excretion. It is not recommended for chest surgery because prolonged basal narcosis is found to be a contributing factor in postoperative chest complications. There is no contraindication to its use for throat surgery. It is indicated in hyperthyroid patients and those patients who prefer to be asleep before going to surgery. It is contraindicated in inflammations or lesions of the rectum or large bowel, in operations in the region of the rectum, and in any condition which produces a definite deviation from the physical normal, such as fever, anemia, obesity, cardiac or respiratory affections, and renal or hepatic lesions.

The author's present routine consists of administering an enema from 6 to 12 hours before surgery and giving atropine (gr. 1/100) 10 minutes following the avertin injection. The avertin dose is 1/10 for a gram per kilogram, with a maximum of 8 gm. Trichlorethyl alcohol was used in a group of 18 cases. This drug was found to be more hypnotic and to cause less respiratory depression than avertin. It caused excitement both during the onset of narcosis and during recovery, and the eighteenth case presented cardiac failure early during the onset of narcosis. For this reason the use of trichlorethyl alcohol was discontinued. MARY KARP, M.D.

PHYSICOCHEMICAL METHODS IN SURGERY

ROENTGENOLOGY

Packard, C.: Roentgen Radiations in Biological Research. *Radiology*, 1945, 45: 522.

This article summarizes the study of the effect of the roentgen rays on living cells since Roentgen's discovery in 1895, and the use to which these effects have been put in biological research. It was discovered early that x-rays were of little use as a bactericidal agent, but that large doses resulted in the coagulation of plant and animal cell protoplasm. There was early recognition of the sterilizing effect of the x-rays on animals, and both radium and roentgen rays have been of use in analyzing the role played by the cytoplasmic portion of the sperm and egg, since it has been found that the nuclei of gametes can be injured in varying degrees without preventing cleavage of the egg.

Three types of chromosome change following irradiation have proved important cytogenetically; by causing an increase in the number of mutations and chromosomal aberrations over the rate found in nature, and apparently giving rise to the same alterations in the hereditary material as in the spontaneous cases, x-rays furnish a valuable means of study of such phenomena. The first of these small changes consists of the increased stickiness of pairs of chromosomes which causes some of them to stick together instead of separating during the maturation process, with resultant hereditary changes in the offspring. Radiation may increase the frequency of this phenomenon over that found in the offspring of nonirradiated parents by as much as 20 times. The second of these changes consists in the sticking together of certain portions of the chromosomes and their subsequent breaking apart under the pull of spindle fibers with subsequent reattachment of fragments either to the same chromosome in their original orientation or in reverse position, or to the broken ends of other chromosomes. Precise determination of the chromosomes involved and the fate of their parts has been achieved in careful experiments. The third effect is a change in the gene itself, which greatly increases the mutation rate (Muller in 1927, working with drosophila); this increase is proportional to the amount of energy absorbed.

Sensitivity to radiation changes rapidly during mitosis, but whether prophase, metaphase, or telephase is the most vulnerable period is still in dispute. It was demonstrated by Bergonie and Tribondeau in 1906 that the sensitivity of cells in general varies with their reproductive capacity and inversely with their degree of differentiation, and it has been established that during the development of an organism there is a progressive loss of sensitivity. Although decrease in sensitivity is synchronous with decrease in growth velocity, experiments which induce increase in the normal growth rate have not produced a comparable increase in radiation effect. It appears that when cell division and metabolism are at a minimum, as during chilling, cells have a better opportunity to recover from their injury; but Henshaw and Francis, working with wheat seeds, found no quantitative relation between susceptibility and water absorption, oxygen consumption, and mitosis, although sensitivity rises when water is absorbed and growth commences.

There is general agreement that the primary effect of irradiation on the tissues is an ionization, resulting in transformation of complex molecules to simpler ones, but the precise point of primary attack and the pattern of chain reactions which may be precipitated has yet to be worked out. X-rays have been repeatedly shown to have no direct effect on oxygen consumption, but work by Crabtree and Gray indicates that they have an effect on glycolysis, and work by Dale, that they inactivate dilute carboxypeptidase, while Sparrow states that perhaps the sensitivity to x-rays may be correlated with the nucleic acid metabolism.

In 1904 Koernicke demonstrated the ability of organisms to recover from x-ray injury, but it was not until 1932 that Henshaw offered quantitative data in proof of the generally accepted principle that when x-ray intensity is low the rate of repair is sufficient to balance the rate of injury. He found that when arabacia eggs are irradiated and then fertilized, the onset of division is delayed, the delay being an exponential function of the time interval between the end of exposure and the moment of fertilization, and the period of recovery apparently being limited to the quiescent interval between irradiation and fertilization.

LILIAN DONALDSON, M.D.

Sinberg, S.E., and Burman, M. S.: Roentgenological Visualization of the Fractured Temporal Styloid Process. *Radiology*, 1945, 45: 599.

The roentgen visualization of the temporal styloid process is often difficult. The lower part of the bone may be seen in posteroanterior roentgenograms made for the demonstration of the maxillary sinuses, in the open mouth view of the edentulous patient, and in the lateral view of the nasopharynx and neck, but the entire bone is shown rarely.

The authors became interested in the roentgen visualization of the styloid process in connection with 2 rather unusual cases which are described in the text and illustrated with their respective roentgenograms.

A technique developed from that of Kaplan was found to be of definite value. It is given as follows:

For visualization of the right styloid process, the patient is seated in the right oblique position (about 15 degrees) with head bent to the right at an angle of

about 10 degrees. The head is extended about 10 degrees to bring the mandible out of the line of the styloid. The cassette is placed upon the patient's right shoulder and held firmly against the side of the neck and head by his right hand. The x-ray tube is set from 20 to 30 cm. to the left of the patient, approximately 10 cm. anterior to and at the level of the patient's knees. The tube is then tilted upward about 45 degrees and backward about 30 degrees, so that the central ray enters the left side of the neck in an oblique and upward direction from 3 to 4 cm. below the angle of the mandible.

By making use of this technique the authors were able to demonstrate a fracture of the temporal styloid process in both cases. T. LEUCUTIA, M.D.

Renander, A.: Roentgenologically Examined Case of Cancer of the Thymus Gland (Röntgenologisch untersuchter Fall von Cancer thymi). *Acta. radiol.*, Stockh., 1945, 26: 297.

The concensus of roentgenologists is that roentgenograms of malignant tumors of the thymus gland are not characteristic enough to allow a definite diagnosis. However, Lenk called attention to certain features which permit a correct diagnosis in a large percentage of cases. The author of this article describes a case of cancer of the thymus gland in which the picture differed in certain respects from that considered as characteristic for malignant tumor of the thymus gland by Lenk.

According to the prevailing opinion, the medullary substance of the thymus gland is of entodermal origin and therefore belongs to the epithelial structures, while the cortical substance is formed mostly by cells deriving from lymphocytes. It follows that malignant medullary tumors of the thymus gland may be considered carcinomas, while cortical tumors belong to the group of lymphosarcomas. This classification must be kept in mind when x-ray irradiation is employed for diagnostic purposes because a carcinoma of the thymus gland is very radioresistant while a sarcoma yields to the therapy promptly, resembling the lymphosarcoma of the mediastinal glands in this respect. In this manner a carcinoma can be differentiated from a lymphosarcoma.

The clinical picture is dominated by pressure symptoms. Frequently signs of congestion in the region of the superior vena cava are noticed; later on, dyspnea, cachexia, and metastases develop.

According to Lenk, malignant tumors of the thymus gland located in the anterior mediastinum form more or less symmetrical tumefactions, which as a rule reach the base of the heart. In contradistinction to glandular tumors located in the anterior mediastinum, the upper border of a thymus tumor does not reach the "jugulum." As a rule, a thymus tumor has a rounded shape with polycyclic margins, while glandular tumors form relatively short arches. Long arch formations are characteristic for thymus tumors. Contrary to glandular tumors, the transverse diameter of thymus tumors exceeds that of the longitudinal diameter, this being due to the growth of thymus tumors within a preformed capsule. In roentgenograms the thymus tumor forms a sharp outline unless the tumor mass penetrates the capsule and infiltrates the adjacent pulmonary tissues. A thymus tumor usually causes a displacement of the adjoining organs. Dermoid cysts, accessory goiters, and aneurysms are characterized by an asymmetrical shape.

In a case of malignant thymus tumor in a 75 year old man observed by the author, the type of the mediastinal tumor could not be determined roentgenologically. A paresis of the phrenic nerve and an enlarged cervical gland suggested malignancy. The diagnosis was supported by the asymmetrical shape and an extension of the mediastinal tumor into the right cervical region. A complete regression of the enlarged cervical gland under the influence of x-ray treatment supported the diagnosis of malignancy of a lymph gland. On the other hand, the outlines of the tumor in the roentgenograms were sharp; long polycyclic arches were noticed; and the transverse diameter of the shadow was slightly longer than the longitudinal diameter. The microscopic examination of the tumor revealed a cancer of the thymus gland.

JOSEPH K. NARAT, M.D.

Dunner, L., Hermon, R., and Bagnall, D. J. T.: Pneumoconiosis in Radiator and Boiler Finishers. *Brit. J. Radiol.*, 1945, 18: 377.

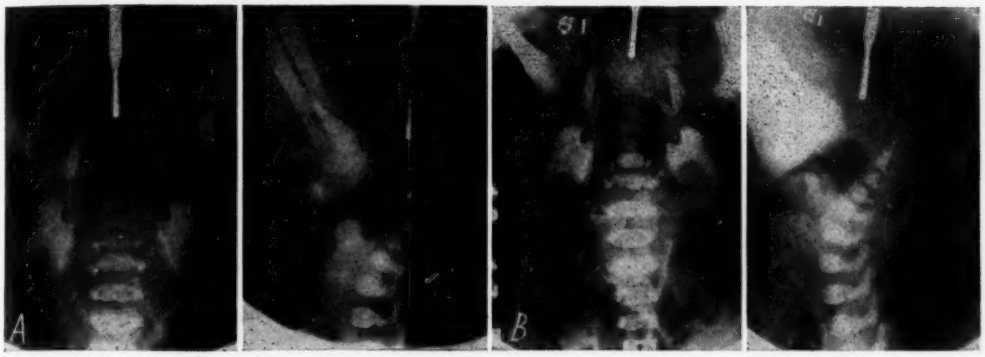
Chest roentgenographs of 13 boiler fettlers and radiator finishers showed signs of pneumoconiosis in 10. Only 2 had disabling complaints and the chest films of 1 of these 2 men were essentially negative. The authors attribute the roentgenographic findings to inhalation of dust consisting of sand (from the casting molds), iron, and oil. The exposures ranged from 9 to 36 years.

An analysis of 3 dust specimens, which were obtained by different collecting methods, showed that the content or iron ranged up to 6.5 per cent. The main constituent was silica. Its solubility depended on the size of the particles. The amount of soluble silica did not exceed 0.45 per cent. The average size of the particles was 5 microns in the unfiltered specimen. GERHART S. SCHWARZ, M.D.

Wilson, A. K.: Roentgen Examination in Congenital Intestinal Obstructive Defects in Infants. *Am. J. Roentg.*, 1945, 54: 498.

The author presents 3 cases of congenital obstructing anomalies of the intestinal tract in newborn infants, and describes the roentgen techniques used in ascertaining the point of obstruction.

For cases of imperforate anus and rectal atresia he uses the method described by Wangensteen and Rice in 1930 whereby gas in the large intestine is used to delineate the blind end of the rectal pouch by suspending the infant head down and placing a radiopaque object in the anal dimple. This demonstrates the extent of separation between the blind end of the rectum and the perineum to aid the surgeon in determining whether a perineal approach is feasible. In



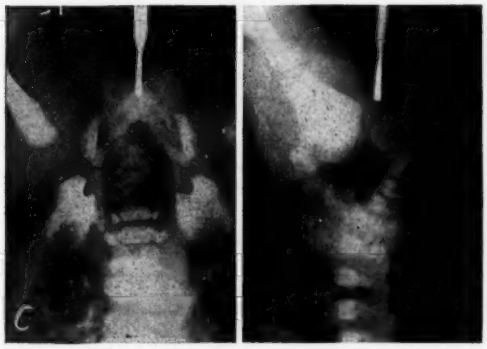


Fig. 1. Case 1. Anteroposterior and lateral views made (a) immediately, (b) 5 minutes after, and (c) 10 minutes after the infant was suspended head down. Note gradually increasing ascent of gas in rectal pouch, and that there is greater clarity of detail and less risk of erroneous measurement in the lateral projection. The tip of the thermometer is in contact with the anal dimple.

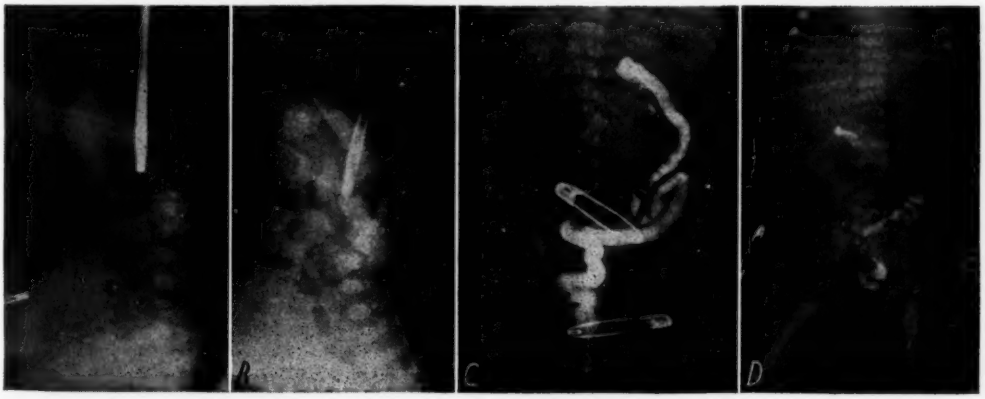


Fig. 2. Case 3. The findings in (a), reproduced from a roentgenogram made 10 minutes after the infant was suspended head down, show evidence suggestive of high rectal imperforation. This was disproved by insufflation of air (b) and the injection of iodized oil (c). The partially calcified enterocyst is seen in (c) and (d) in close proximity to the mobile proximal end of the colon.

cases showing an anal pouch, injection of opaque medium is recommended for an accurate estimate of the depth of tissue between the anal membrane or perineal surface and the blind end of the rectal pouch.

In one of the cases presented 5 per cent lactose was given by mouth some hours before examination in order to increase gas formation in the bowel in the newborn. Roentgenograms were then made at least 5, and preferably 10, minutes after the infant was inverted, in both the anteroposterior and the lateral projections. It was found that if films were made immediately after inversion, the gas might not have reached the distalmost portion of the rectal pouch, whereas the gas localization after 10 minutes corresponded well with subsequent surgical findings. The lateral projection was found of greater value in estimating the thickness of the tissue between the rectal pouch and the perineal skin surface, since the pelvic curve of the intestine foreshortens the distance between these points in the anteroposterior view. The latter projection may be of value, however, in demonstrating possible deviation to the left or right of the terminal end of the rectum.

The first case was that of a premature male infant, with no anal orifice but with an anal dimple. It was given ½ ounce of 5 per cent lactose by mouth approximately 12, 15, and 18 hours after birth, and at 27 hours was suspended head down with a thermometer tip in apposition to the anal dimple. Anteroposterior and lateral films were taken immediately, and 5 minutes and 10 minutes after suspension, and the lateral views showed the distance between the gas-distended, closed end of the rectum and the tip of the thermometer to be, respectively, 2.5 cm., 1.5 cm., and 1 cm. (Fig. 1). Confirmation of the accuracy of the 10 minute film was obtained an hour later when incision was made through the anal dimple and the blind pouch was encountered 1 cm. above the cutaneous margin.

The second case was similar to the first.

The third case was that of a premature female infant who developed persistent projectile vomiting about 2 hours after birth. The first films (Fig. 2), made 28 hours after birth by the method described, tended to support the clinical impression of high rectal atresia as there was considerable distance between the tip of the rectal catheter and the collection of rectal gas. The insufflation of air and injection of 15 c.c. of iodized oil, however, demonstrated free passage up the colon as far as the transverse portion which was displaced to the left by a large movable partially calcified cystic mass. In spite of ileostomy the infant died 60 hours after birth. Autopsy showed a large enterocyst joined to the terminal ileum by a fibrous strand and to the midileum by an almost atretic loop, while the terminal ileum ended blindly a few centimeters from the colon.

Cases 2 and 3 were the only cases of imperforate anus or intestinal atresia found among 9,474 living babies born in the Hospital of St. Vincent de Paul, Norfolk, Va., between 1923 and 1944.

LILIAN DONALDSON, M.D.

Isaac, F.: Roentgen Findings in Amebic Disease of the Liver. *Radiology*, 1945, 45: 581.

The author calls attention to amebic disease of the liver, manifested first as a diffuse hepatitis and progressing in some instances to the formation of solitary or multiple liver abscesses, as the most common complication of amebic dysentery, and reports that of the 222 cases of such dysentery reviewed at an Army hospital overseas, 32 (14%) were diagnosed as presenting liver involvement.

The onset of this complication is usually insidious with only anorexia, malaise, and vague epigastric distress, with the result that the patient may not appear for diagnosis until several months after an initial attack of diarrhea, and then usually with only low grade fever, moderate leucocytosis, an elevated sedimentation rate, and tenderness over the liver without any frank pathognomonic signs on physical examination. For this reason the author believes the associated roentgen changes, if present, may be of considerable help in suggesting or clinching the diagnosis.

Of the 32 cases diagnosed as amebic hepatitis, 22 were examined roentgenologically; of these, 10 (45%) showed elevation of the right leaf of the diaphragm in the chest films, and fluoroscopy movement of the diaphragm was reduced or absent. In regions where amebic dysentery is prevalent, the author regards these roentgen findings pathognomonic of amebic liver disease. Secondary compression of markings in the base of the right lung frequently accompanied the diaphragmatic elevation, and occasionally there was a little pulmonary infiltration. In a few instances minimal right costophrenic pleuritis and effusion were also encountered, which the author believes was due to rupture of a liver abcess into the pleural cavity. Prone abdominal films were not always helpful, but in some cases they did show a downward extension of the inferior hepatic border as related to the costal margin.

Following a course of emetine therapy these roentgen signs disappeared but more slowly than the symptoms. In only a very small percentage of cases did amebic liver disease require aspiration.

LILIAN DONALDSON, M.D.

Brooke, H. H. W., MacKenzie, W. C., and Smith, J. R.: Pneumoroentgenography with Oxygen in the Diagnosis of Internal Derangements of the Knee Joint. *Am. J. Roentg.*, 1945, 54: 462.

The authors used oxygen pneumoroentgenography for the diagnosis of internal derangements of the knee joint whenever the clinical evaluation remained inconclusive and the routine roentgen examination failed to help although the symptoms strongly suggested some sort of disability.

A total of 25 cases were examined, of which 18 showed positive findings. Ten cases came to operation and in all but 1 the roentgen findings were confirmed. The failure in the tenth case was attributed to insufficient removal of the synovial fluid and incomplete filling of the joint cavity with oxygen.

The authors give in detail the anatomic and surgical considerations. The procedure must be done in the operating room under aseptic conditions. From 100 to 140 c.c. is the optimum amount of oxygen necessary for good filling. Collodion is applied to the needle puncture site and then the patient is taken to the roentgen department on a stretcher. Roentgenograms are made in standard positions. The use of the curved cassette holder and multiple stereo projections are, however, of definite value.

In the interpretation of the abnormal pneumoroentgenogram of the knee joint the following points were found to have diagnostic significance: (1) roughening and narrowing of the cartilage surfaces, either of the articular surface coverings or of the semilunar cartilages; (2) uninterrupted gas columns along the inner aspect of the collateral ligaments of the joint where capsular structure should be firmly attached to the periphery of the menisci; (3) increased density in the intercondylar or nonarticular region with a corresponding lack of density in the lateral or medial region of the joint; (4) separation of the meniscus shadow from the contiguous bone structures; (5) calcified and, more especially, noncalcified loose or semiloose bodies (joint mice); (6) narrowing of the joint space; and (7) exostosis or eburnation of the articular surfaces. The last three findings can also be demonstrated in the routine roentgenograms of the knee.

The conclusion is reached that the method is a useful adjunct in well selected cases. Under aseptic surgical conditions it carries little risk of complications. T. Leucutia, M.D.

Coolidge, W. D., and Charlton, E. E.: Roentgen Ray Tubes. *Radiology*, 1945, 45: 449.

The authors describe the technological development of x-ray tubes from the simple gas discharge tube first used by Roentgen, in which the glass wall of the tube functioned haphazardly as the x-ray emitting target under bombardment by electrons, to the one hundred million volt circular induction electron accelerator tube, which promises to become not only a widely used instrument in medicine and industry but also a source of unpredictable scientific information.

There are essentially 3 groups of x-ray tubes:

1. Gas filled tubes, most of which operate with a cold cathode. They are antiquated mainly because of their instability, and the impossibility of controlling the current passing through them and of choosing the voltage applicable to them independently from current and gas pressure.

2. High vacuum tubes with a cold cathode (so-called field current tubes), which did not gain acceptance for similar reasons.

3. High vacuum tubes with a hot cathode. This type of tube is the only kind used extensively today. It was developed by one of the two authors (Coolidge) whose name it bears. Encouraged by the work of Langmuir he developed a hot cathode which consisted of an electrically heated tungsten filament; whereas Lilienfeld tried to solve this problem by introducing an auxiliary hot cathode which produced electrons in a separate ignition chamber.

Coolidge tubes have now been developed to cover a wide range of usefulness. They vary in size from that of an oil immersed dental tube with a bulb diameter of 1½ inches and a length of 4 inches up to that of the 1,400,000 volt tube of the National Bureau of Standards which is 12 inches wide and 24 feet long. The effective wave length of the radiation generated in such tubes ranges from 0.00025 Ångstrom at 100,000,000 volts to 25.0 Ångstrom at 1000 volts. (A table showing the relationship of the factors is given.) The efficiency of these tubes increases with the voltage. Whereas at 96,000 volts only 0.2 per cent of the cathode ray energy is transformed into x-rays in the target, the measured efficiency reaches 10.4 per cent at 2,350,000 volts. (A table showing the wave lengths and the efficiency relation is given also.) The advantages of Coolidge tubes over others are described.

Further technical developments are as follows:

For roentgenographic tubes.

Development of a rapidly cooling tungsten target brazed into a solid or hollow copper block which, in turn, is cooled by (1) possessing a large heat capacity, (2) with stagnant or circulating air by means of radiator fins, (3) with water, and (4) by a spontaneous or forced circulation of oil passing through the back of the target, which in turn is cooled by air or other media.

Development of the line focus, a rectangular focus, which by having a slant of 20 per cent (the angle being made by the target surface and the central x-ray beam), appears foreshortened in the useful projection, thus equaling a square focus. This line focus is able to withstand the 3 fold load of an ordinary focus of the same projected size. (Values for other angles and curves for load limits are given).

Development of target sizes varying from 1 to 9 mm. in diameter for different purposes. The allowable loading varies from about 50 to 600 watts per square millimeter.

Development of double focus tubes. Tubes having two foci of different size allow rapid changeover from flouroscopy to roentgenography, which is necessary for the so-called "spot film" medical roentgenography and other two purpose raying.

Development of a rotating target which allows the constant advance of relatively cold metal to the electron bombardment during a given exposure. In modern rotating target tubes the anode disc rotates with from 3000 to 3500 revolutions per minute. The gain in loading, over the stationary target, is then about 10 fold and is generally proportional to the target speed. (A table for the various speeds and exposure times is given). The line focus principle is maintained in these tubes. Technical difficulties with the target bearings still exist but have been overcome in part by coating the bearing balls with silver or barium.

For therapy tubes:

Development of improved cooling of a solid tungsten target which is allowed to heat up to high temperatures. Since an x-ray treatment may last for up to an hour, the tubes have to be designed for continuous operation. (The focal spot is allowed to be larger than for diagnostic tubes.)

Insertion of a beryllium metal window into the glass wall of the x-ray tube for superficial therapy to allow the passage of very soft x-rays, from 5 to 10,000 volts for superficial therapy.

The use of thick walled pyrex glass for from 200 to 400 kv. deep therapy tubes to prevent the occurrence of punctures.

The use of a metal hooded target to improve the electric field distribution. This will not allow the secondary electrons emanating from the target to reach the glass wall and thus cause punctures. The metal hood may be made to include a beryllium window.

Use of the x-ray beam "transmitted" through the target instead of the conventionally used "reflected" beam. This principle is of value for the operation of contact and body cavity tubes. It is a necessary one in the use of supervoltage machines if the voltage is to exceed several million volts because of the peculiar angular distribution of highly penetrating x-rays. (Data for the angular distribution at various voltages are given.)

Development of multisectional tubes for 1,000,000 volt machines which allow a more even distribution of the voltage gradient within these tubes by the use of a number of ring shaped electrodes connected to different intermediate voltages. This principle is of special value in the 2,000,000 volt mobile resonance transformer unit in which the tube is surrounded by the transformer coils and the electrodes connected to a number of coil taps.

For diffraction tubes:

Use of several windows permitting the simultaneous diffraction or spectrographic study of several specimens. Diffraction tubes operate usually on between 30 and 45 kv. and utilize the characteristic radiation of various target metals, e.g., copper and molybdenum.

For all types of tubes:

Development of x-ray proof and shock proof tube housings. This more than anything else enables us to enjoy the use of flexible comparatively safe x-ray equipment without which modern radiology is unthinkable.

Most of the described technical advances were made possible only by the Coolidge tube principle.

GERHART S. SCHWARZ, M.D.

MISCELLANEOUS

CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

Loutit, J. F., and Maunsell, K.: The Prevention of Homologous Serum Jaundice. *Brit. M. J.*, 1945, 2:759.

Homologous serum jaundice occurs from 40 to 160 days after the introduction of a foreign homologous serum into a recipient. Its occurrence may be accidental, as in so-called "syringe jaundice", which is believed to result from the injection of traces of foreign blood left in an inadequately cleaned syringe; it may occur following the deliberate injection of serum or plasma as a transfusion, or of convalescent serum given as a prophylactic in measles and mumps, or following yellow fever vaccination in which human serum is the suspension medium for the killed virus. As to the accidental variety, adequate cleaning and sterilization of syringes and needles has been shown to reduce the incidence of jaundice practically to zero. When the introduction of serum is deliberate, the prevention of homologous serum jaundice is much more difficult. The yellow fever vaccine problem was solved only by giving up the use of serum as a suspension medium.

This report deals with the results of the introduction of single sera into a number of recipients and a comparison of the incidence of jaundice in these cases with that in a series of cases subjected only to blood transfusions. Blood was drawn from 99 separate donors under sterile conditions; of these, 76 had had no previous known attacks of jaundice; 15 had had jaundice, apparently from infective hepatitis, for some months to many years previously; 4 had had homologous serum jaundice some months previously; and 4 were donors who had contributed the only blood which had been used for transfusion to a man with hematemesis who 6 weeks later developed jaundice. Of 98 donors followed up for 4 months, 94 had no complaints, 3 had bilious attacks, 1 donor had a skin rash, and none had jaundice. Of 602 recipients of sera from the 99 donors, 573 could be followed; none of them reported jaundice, but 11 reported bilious attacks and 3 reported skin rashes. It is probable that the bilious attacks and skin rashes were nonspecific in both series.

For comparison, 213 patients who had received whole blood or concentrated red cell suspension were studied over a period of 2 months or more. No case of frank homologous serum jaundice occurred in this series, although there was 1 case of jaundice diagnosed as infective hepatitis and 1 case diagnosed as hepatitis without jaundice. The findings confirm the impression that homologous serum jaundice occurs only rarely after transfusion with whole blood. This is probably due to the fact that patients receiving transfusions of whole blood alone get homologous material from a few donors only. In addition to this follow-up, only 2 cases suggesting a relationship between whole blood transfusion and subsequent hepatitis have been found. In these cases blood was received from more than 1 donor (4 and 52 donors, respectively). It is recommended that for therapeutic and prophylactic purposes the serum used should be from a single individual, or from a few persons only.

JOHN L. LINDQUIST, M.D.

Harrison, F. F., and Miller, J. K.: The Problem of Hemolytic Streptococcus Carriers in Hospital Personnel. *War. Med., Chic.*, 1945, 8: 333.

A situation is described in which the occurrence of 2 postoperative infections in aseptic cases seemed to be related to a high hemolytic streptococcus carrier rate among the surgical personnel. The carrier rate was not effectually reduced by chemotherapy. A comparison was made of the incidence of streptococci in the throats of the surgical personnel and of the patients, and in the wounds of patients during the winter months of 1944 and 1945.

The authors suggest that as a precautionary measure periodic surveys of the flora of the throats of surgical personnel be made.

WALTER H. NADLER, M.D.

Snell, A. M., Wood, D. A., and Meienberg, L. J.: Infectious Hepatitis, with Especial Reference to its Occurrence in Wounded Men. *Gastroenterology*, 1945, 5:241.

Infectious hepatitis has currently manifested itself as three more or less distinct clinical entities: the common epidemic jaundice, postvaccinal (yellow fever) hepatitis, and homologous serum jaundice. There is no reason to presuppose any fundamental difference in these conditions, the clinical variations probably being due to the route of inoculation and to the general condition of the affected individual. While the supposed relation of the three syndromes is not proved, it is generally agreed that all fatal cases of any of the three types have shown a common picture at autopsy, namely, that of acute or subacute (yellow) atrophy of the liver.

This report deals with the cases of 32 patients who developed jaundice on an average of 84 days following a wound. All of the patients had received blood and plasma at the time of injury, and it is believed that the ensuing hepatitis may have resulted from an icterogenic agent contained therein. Twenty-six of the patients recovered, the remaining 6 expiring on an average of 1 week after the jaundice was first noted. The initial symptoms at the time of the appearance of hepatitis were almost identical with those described in ordinary epidemic or catarrhal jaundice. Anorexia, nausea, vomiting, general malaise, and fever were first noted and after an interval of from 1 to 16 days jaundice appeared. Eight

patients, including the 6 who died, developed marked symptoms and signs of involvement of the central nervous system. Suprisingly, the liver and spleen were rarely palpably enlarged in the early stages of the disease. Cephalin-cholesterol flocculation tests were positive in all of the patients at some time during their illness. Although the studies of the hepatic function were limited to those required by medical necessity, all of the studies revealed less deviation from the normal than might have been expected. Essential pathological findings in the liver in the 6 fatal cases consisted of an acute autolytic process which was diffuse and most marked in the central and midzonal areas of the liver lobule. Little evidence of regeneration or repair was observed in these cases, presumably because of their brief and violent course.

There was no evidence that the disease had been transmitted by droplet infection to other patients in the ward. A laboratory worker who inadvertently drew up a mouthful of serum from a fatal case developed a mild form of the disease 19 days later. There is ample evidence that the preicteric phase of hepatitis may be detected clinically in these cases, as in the experimentally produced variety of the disease. In 1 case it was predicted that jaundice would develop on the basis of two positive cephalin-cholesterol flocculation tests on 2 different days. From this and similar observations it is believed that the cephalin-cholesterol flocculation test becomes positive long before clinical symptoms develop and is probably the earliest evidence of an impending acute hepatitis to be obtained in wounded men.

The authors could not be certain that these cases of severe hepatitis were due to what has been called homologous serum or transfusion jaundice. The incubation period corresponded closely to that seen in hepatitis following yellow fever vaccination and in experimentally produced serum jaundice. The average course prior to the development of serious symptoms in post vaccinal hepatitis is about 26 days, as contrasted to 3 or 4 days in this series. Two possibilities suggest themselves as to why the disease should follow so serious a course in the wounded men in this series: (1) that the amount of icterogenic material was very much larger than that transmitted in vaccinal hepatitis or in experimental serum jaundice; and (2) that the general nutritional depletion of the wounded men makes them especially vulnerable. The latter view seems the more reasonable.

The essential requirement for the prevention of serum jaundice in wounded men is elimination of the use of blood or plasma containing the icterogenic agent. The practical difficulties of doing this are great. The prevention of fatalities from serum jaundice occurring in wounded men must begin with the maintenance of the general nutrition of the patients and the correction of protein and vitamin deficiencies if such exist. Early detection of the preicteric phase is also a matter of considerable importance, as specific treatment may save lives and shorten convalescence. JOHN L. LINDQUIST, M.D.

Dorgeloh, J. R., and Tully, P. W.: The Relationship of Boeck's Sarcoid and Tuberculosis: Report of a Case in Which Tuberculosis of the Lymph Nodes was Associated with Features Highly Suggestive of Sarcoid. *Arch. Path.*, Chic., 1945, 40: 309.

Tuberculosis of a cervical lymph node was found in a patient exhibiting no cutaneous reaction to tuberculin. Portions of the lesion presented caseation with acid-fast bacilli; in other areas, however, the histological picture was indistinguishable from that of Boeck's sarcoid. It is believed that this case lends additional weight to the argument that sarcoidosis, in some instances at least, is an atypical reaction to tubercle bacilli or their products.

That this relationship may occur, even though bacilli usually are not demonstrable in the lesions of sarcoidosis, is substantiated by the occurrence of the organism free "id" reactions of leprosy and mycotic infections, and the generally conceded relationship of streptococci to rheumatic fever and glomerulonephritis. SAMUEL KAHN, M.D.

Kline, B. E., Miller, J. A., Rusch, H. P., and Baumann, C. A.: Certain Effects of Dietary Fats on the Production of Liver Tumors in Rats Fed p-Dimethylaminoazobenzene. *Cancer Res.*, 1946, 6: 5.

Six groups of 15 rats each were fed 0.06 per cent of p-dimethylaminoazobenzene for 4 months in synthetic diets containing: (1) no fat, (2) 5 per cent of corn oil, (3) 5 per cent of olive oil, (4) 20 per cent of corn oil, (5) 20 per cent of Crisco, and (6) 20 per cent of lard. Then a dye free diet was given for 2 months. A final incidence of liver tumors of 23 per cent was produced by the low fat diet, as compared with 94 and 53 per cent, respectively, when the diet contained 5 per cent of corn oil or olive oil. When 20 per cent of corn oil was fed to the rats, large tumors were present before 4 months, and the incidence of tumors at this time was 100 per cent. When 20 per cent of Crisco or lard was given, the incidence of tumors at 6 months was 87 per cent.

These data demonstrate the fact that, in general, p-dimethylaminoazobenzene is more carcinogenic when the diet contains fat; they show, further, that the incidence of hepatomas is higher in rats given a diet containing 20 per cent corn oil than in those receiving a diet with 5 per cent corn oil. It is, therefore, apparent, that the level of the fat in the diet, as well as the type of fat, is important for the formation of hepatic tumors by p-dimethylaminoazobenzene. SAMUEL KAHN, M.D.

Khanolkar, V. R., and Suryabai, B: Cancer in Relation to Usages: 3 New Types in India. *Arch. Path.*, Chic., 1945, 40: 351.

Three new types of cancer are found in different regions of India, namely, Bombay, Vizagapatam,

and Patna. They may be called the dhoti, chutta, and khaini cancers. They are associated with the wearing of a light garment (the dhoti), the smoking of a cigar (the chutta) with the lighted end in the mouth, and the depositing of tobacco and lime (khaini) behind the lower lip of the mouth. A histological study of the lesions which precede the development of two of these cancers reveals a similarity of appearance between them and the precancerous stages in mice which have been painted experimentally with carcinogenic substances.

The observations reported and a review of the available experimental literature on the subject of changes in the skin as a result of exposure to mechanical and thermal irritants lead to the conclusion that in the induction of the tumors described the part played by the reaction of the tissues which are the seat of the cancer is equal in importance to that played by the carcinogenic substances themselves.

Saphir, O., Appel, M., and Levinthal, D. H.: Attempts to Localize Tumor Metastases in the Long Bones by Mechanical Trauma. *Cancer Res.*, 1945, 5: 722.

This experimental study was undertaken in order to ascertain whether or not trauma applied to the long bones might be influential in the localization of metastases from a transplanted malignant tumor. The Brown-Pearce rabbit tumor, which is highly malignant and readily transplantable into the testes, was used throughout the study. Attempts were made to localize metastases in the long bones by a single mechanical trauma and by chronic irritation. Bone metastases have not been observed in the stock rabbits except in the spinal column, and then but rarely. In order to determine whether or not the Brown-Pearce carcinoma grows in long bones, transplants were made directly into the femur in 6 normal male rabbits. The tumor grew well within the marrow spaces in all, soon invaded the periosteum and adjacent muscles, and metastasized extensively.

Trauma to the bones was produced by simple fracture of the humerus. In a series of 21 rabbits the left humerus was fractured and immediately afterward an intravenous injection of a suspension of tumor cells was made into the ear vein. In a second series of 12 rabbits the humerus was fractured and 14 days later a similar injection was made. In a third series of 12 animals, the tumor was transplanted into the testes. Two weeks later, after the testicular tumor was easily palpable, the humerus was fractured. In 2 other series chronic mechanical irritation was produced by implanting a small, rough piece of vitallium immediately beneath the periosteum of the femur, beneath the quadriceps tendon, so that with each movement of the leg the metal rubbed against the bone. Six weeks later the intravenous or intratesticular transplantation of tumor was done. Only those animals that died of extensive tumor metastases were considered.

Roentgenograms and autopsy studies of the material showed no evidence of tumor cells at either fracture sites or sites of mechanical irritation in any of the animals. It is concluded that mechanical trauma or chronic irritation of the bones played no role in the localization of metastases from transplanted Brown-Pearce carcinoma in rabbits.

JOHN L. LINDQUIST, M.D.

DUCTLESS GLANDS

Keller, A. D., Lawrence, W. E., and Blair, C. B.: Effects of Varying Degrees of Hypophysectomy on the Dog. *Arch. Path.*, Chic., 1945, 40: 289.

Varying degrees of hypophysectomy were undertaken in dogs, and the animals were maintained for several months after the operation. During the latter stages of their survival, the status of their carbohydrate metabolism was assayed on a quantitative basis.

Sexual regression, cessation of growth, and a marked change in coat were the only effects that could be reliably associated with the removal of the pars anterior per se. The lowering of the carbohydrate reserves, the occurrence and magnitude of the Houssay effect, and a decrease in adrenal function and size were associated with the progressive encroachment on the hypophysial stalk, i.e., subsequent to total removal of the pars anterior and the posterior lobe. The greater the encroachment on the stalk, the greater were these deficits. These facts seem to indicate that the pars tuberalis normally elaborates (presumably in common with the pars anterior) the autacoids which are essential for the maintenance of these functions.

There was essentially no accumulation of fat in the livers of animals showing a nearly maximal Houssay phenomenon. Obesity occurred following (1) hypophysectomy per se, (2) lesions restricted to the hypothalamus, (3) hypophysectomy plus encroachment on the hypothalamus, and (4) section of the stalk plus encroachment on the hypothalamus. The obesity which followed hypothalamic involvement was definitely pathological, and that following hypophysectomy per se was also believed to have a pathological component. Obesity was not encountered when the surgical procedure was limited to section of, or selective removal of, the hypophysial stalk.

In certain instances, in which there was gross infringement on the hypothalamus in addition to total removal of the hypophysial tissue, the deficits in carbohydrate metabolism and adrenal function were submaximal or did not deviate materially from the normal. This suggests the possibility that endocrine principles are elaborated in the immediate environs of the hypothalamus, and that these principles have actions contrary to the actions of certain of the known hypophysial principles.

The term "hypophysectomy," therefore, should not be used indiscriminately. In reporting work done on hypophysectomized animals, it is necessary to describe the type of hypophysectomy attained, not only anatomically, but with respect to the

functional results. In the anatomic examination, the same attention should be focused on the amount of stalk remaining as on the remnants of the pars anterior. SAMUEL KAHN, M.D.

EXPERIMENTAL SURGERY

Kinney, T. D., Haynes, F. W., and Dexter, L.: Experimental Production of Pulmonary Embolism by the Use of a Venous Catheter. *J. Lab. Clin. M.*, 1945, 30: 1013.

To evaluate various methods of therapy for severe thermal burns in rats, the authors have devised a standard burn procedure. This has made it possible (1) to obtain reproducible survival rates; (2) to preserve uninjured extremities; (3) to eliminate the the complication of trauma and hemorrhage from autoingestion; and (4) to preserve uninjured body orifices and permit the voiding of urine and defecation.

The success of the method is dependent on the standardization of all possible conditions. The Wistor rat was used as the test animal and kept under contitions of controlled temperature, humidity, and diet. The food and water intake after the burn had been given was also controlled.

A scald burn of the back was produced on the anesthetized rats by immersion for 15 seconds at 90° C± 0.25°C. A series of burns was produced from the base of the skull to the base of the tail, with the lateral and ventral burned area varied by arching of the back. The burned skin was sharply demarcated and removed in order to calculate the percentage of total body surface burned. By varying the curvature of the back on immersion the burned area can be varied from 45 to 10 per cent. By practice it was found that within this range any desired percentage of surface burn could be reproduced within ± 2 per cent.

In order to obtain reproducible survival percentages for any given percentage of burn administered the initial weights of the burned rats must fall within a closely selected weight band. Two weight bands have been studied extensively: (1) from 190 to 200 gm. and (2) from 200 to 210 gm., and within these two groups all rats receiving burns of 35 per cent or more of the total body surface have died within 48 hours, while all rats receiving burns of 20 per cent or less of the total body surface have survived. The group receiving a burn between 30 and 34 per cent of their total body surface have shown a consistent survival percentage for the combined weight groups of 54 per cent.

No significant difference was found in the relationship of the sex to survival.

Manipulation, such as handling of the burned rats to obtain blood samples, markedly influenced survival. The 50 unhandled rats showed a 54 per cent survival while 50 which were subjected to hemotacrit samplings (7 per animal) showed a 34 per cent survival.

Reproducible survival rates depend on the control of all possible factors, such as the temperature of the bath, time in the bath, weights of the animals and, finally, seasonal variations, for unless controlled they cause a statistically significant difference. Because of the sensitivity of the method to changes in any one of several variable factors it is recommended that simultaneous controls always accompany the experimental groups. HARVEY S. ALLEN, M.D.